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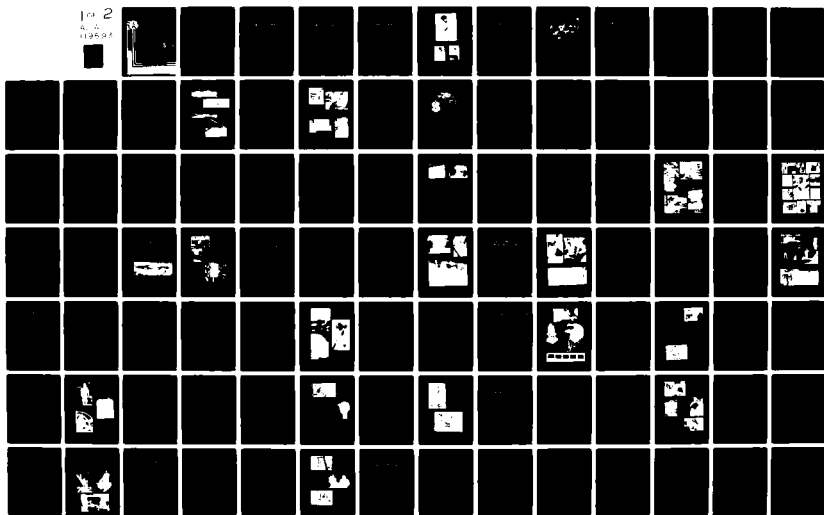
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# US ARMY AEROMEDICAL RESEARCH LABORATORY ANNUAL PROGRESS REPORT, FY 1981

(1 OCTOBER 1980 - 30 SEPTEMBER 1981)

AD A119593

Reported By:

Stanley C. Knapp, Colonel, MC  
Commander

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The annual progress report gives the FY81 personnel and funding strength of the US Army Aeromedical Research Laboratory. It outlines the nine scientific programs being pursued by the Laboratory. Those programs are: visual, auditory, and vibration/impact physiology; auditory effects of blast overpressure; noise hazards of combat vehicles; impact biodynamics of crashworthiness and personnel armor; vibration hazards of combat vehicles; crew life support systems biotechnology; sensory limitations and man/machine systems; biomedical aspects of crew workload, selection and staffing, and antidote and antidote/agent effects on the visual system.		

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# Mission Statement FY 81

Participates in the preservation and enhancement of the health, safety, combat effectiveness, and survivability of the soldier. Conducts life sciences research, development, test, and evaluation in health hazard prevention technologies and aviation medicine concerning human tolerance, survivability, and combat crew effectiveness related to combat vehicles, weapons systems, and operations. Develops, maintains, and applies minimum bases and technologies needed to establish human tolerance and exposure relationships for fire, noise, vibration, impact, and optical hazards, and, complementing other USAMRDC elements, physiological and psychological stressors. Develops and validates technologies for assessment of and protection from these health hazards. Validates those relationships in order to recommend exposure and health effects criteria. Assembles and maintains the psychophysiologic data base required to define operational envelopes for crew safety and effectiveness for Army aviation, combat vehicles, and parachuting. Develops health criteria for associated protective and life support systems. Conducts an active information transfer to health policy, combat and materiel developers, test and evaluation agencies, human factors agencies, and the aviation medicine community.

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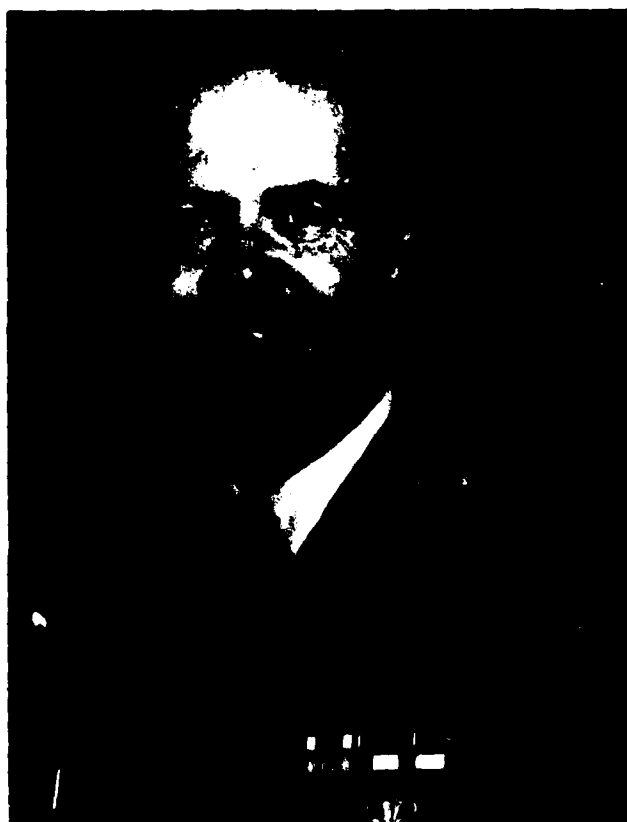
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# Mission Statement FY 82

Conducts research and development on health hazards of Army Aviation, tactical combat vehicles and selected weapon systems. Assesses the health hazards from noise, vibration, acceleration impact and visual demands of such systems, and defines measures to offset hazards. Assesses stress and fatigue in personnel operating these systems and develops countermeasures. Assists in development of criteria upon which to base standards for entry and retention in Army aviation specialities. Assists other USAMRDC laboratories and institutes in research on the bioeffects of laser systems, medical defense against chemical agents, impact of continuous operations on individual and crew performance, and development of improved means of patient evacuation. Assesses current life support equipment to identify causes of failure and devise improved design. Assists the combat developers and materiel developers of new Army aviation and tactical combat vehicle systems to recognize and eliminate health hazards as early as possible in the developmental cycle. Conducts collaborative research with other Department of Defense and other Federal agencies on medical research and development issues of common concern.

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**COL STANLEY C. KNAPP, COMMANDER**



**LTC Roger P. Hula,  
Executive Officer**



**LTC Roger W. Wiley,  
Deputy Commander**

# Introduction

The U. S. Army Aeromedical Research Laboratory (USAARL) is a medical research laboratory of the U. S. Army Medical Research and Development Command (USAMRDC), Office of the Surgeon General. USAARL is a tenant organization at the United States Army Aviation Center, Fort Rucker, Alabama.

The USAARL was established in 1962 to accomplish research in support of the Army aviation community and airborne activities and to provide a central aeromedical research and reference library for the Army aviation effort. Additional mission areas were added to the laboratory in 1974. The laboratory's further expanded mission now includes the assessment of the medical impact of advanced armor and artillery weapons systems and other nonmedical materiel.

Being located at the U. S. Army Aviation Center enables laboratory personnel to follow closely Army aviation developments. The location of other aviation research and development activities at Fort Rucker promotes a team approach to the solution of Army aviation problems.

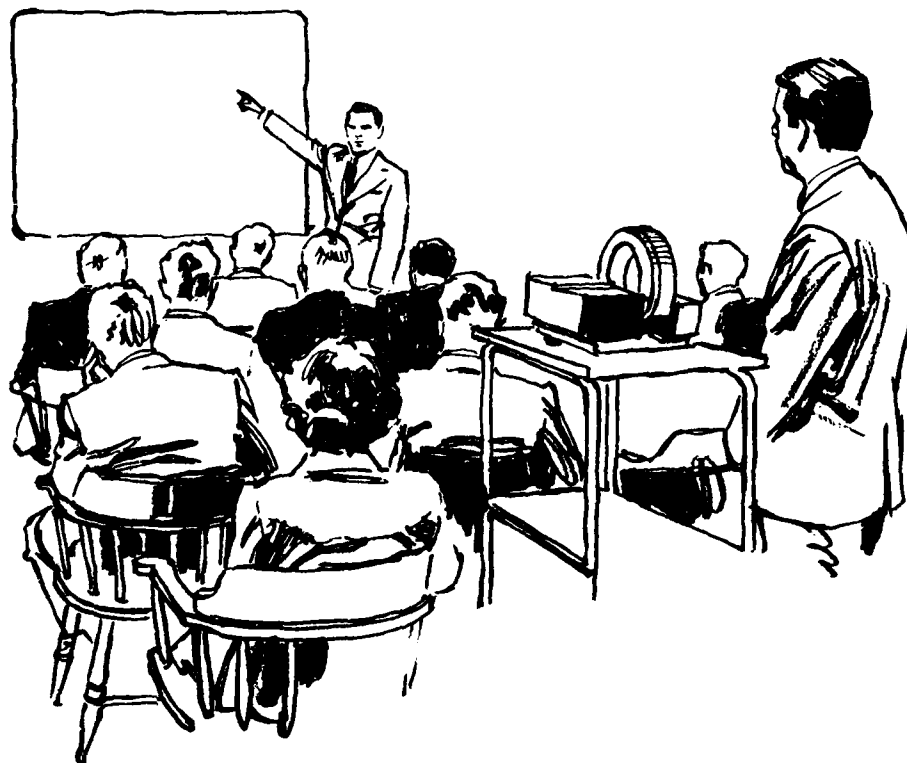
USAARL's close liaison with aviation research laboratories of the Army, of other U. S. Armed Forces, government agencies and the civilian community enhances our research efforts.

USAARL also maintains close coordination with foreign governments of NATO countries on aviation medicine matters through its involvement with the Advisory Group for Aerospace Research and Development (AGARD), a NATO organization.

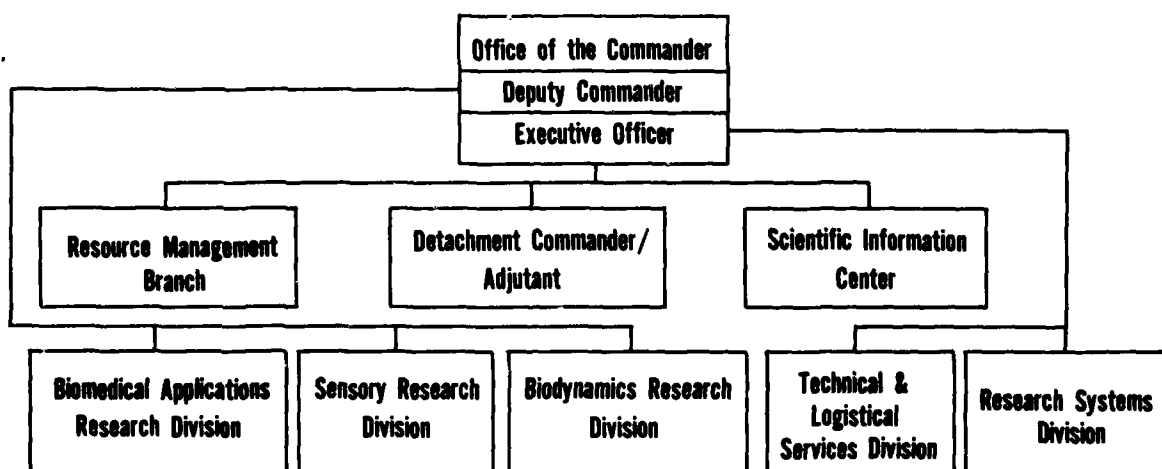
This report gives an overview of USAARL during FY 81, identifies current areas of research and gives a brief description of the research programs. The DA Forms 1498 under which this research work is done are in the Appendix.

This report is prepared to fulfill the requirements of OTSG Regulation 70-31.





**UNITED STATES ARMY AEROMEDICAL RESEARCH LABORATORY  
ORGANIZATIONAL CHART**



# Management

Anticipation and expectation of moving into USAARL's new facility during FY 81 had a profound influence on all USAARL's scientific and management decisions. Management decisions had to be weighed in light of an imminent move that still had not taken place at the end of FY 81. In spite of this "Peril's of Pauline" existence, USAARL moved forward during the year.

An organizational change, designed to improve productivity and enhance the status of scientists by grouping them professionally in relation to program initiatives, was initiated early in FY 81. Most significant in this organizational change was the creation of research groups as professional entities for the conduct of specialized research activities. These are not administrative groups, but groups of scientists who are allowed to perform science free of the administrative burden. Even where groups have only two or three personnel, it is invaluable to have their functions clearly defined within the organization. This of course has increased the workload at the division director level to provide all needed support to these groups.

USAARL research investigators and scientists increasingly are being asked to serve as action officers and staff officers at major Army command (MACOM) and DA levels to brief on research programs and operational issues in which and of which they have been knowledgeable participants. These experiences include participation in "Blue Ribbon" panels, briefing for in-process reviews (IPR), and various high level committee participation. Thus far, the advantages of these experiences have outweighed the adverse impact on investigators' time away from the bench.

The past year has seen an increase in the demand for technology and information transfer. Requests from both foreign and domestic sources have been filled. We expect growth in technology information transfer to continue at an accelerated pace in FY 82 and USAARL will strive to meet this great need.

The extramural contract research program continues to grow. This program directly supports in-house core programs and the laboratory

program overall since each research contract is keyed to a specific in-house work unit. The high potential for growth in this area should allow USAARL to capitalize on in-house and extramural talents.

Traditionally, USAARL has demonstrated its scientific responsiveness to the user community through execution of customer-funded research studies. Customer-funded research studies have provided exceptional dividends to USAARL by helping offset some effects of inflation and by helping new start projects relevant to the core mission programs. During the past years, much of this work was relevant to emerging major weapon systems. Through these studies we have gained in technology, experience, and interface with the Army in the field.

An equipment planning, usage, and control program was established for identification and disposal of excess equipment, for programming and budgeting of special purpose equipment, and for long-range planning for unique research equipment. We expect this program to increase the effectiveness of each dollar that goes into research equipment and thereby enhance our research programs.

Establishing an in-house incentive awards committee in FY 81 improved the quality of incentive awards nominations. The commander established this committee to help evaluate all civilian award nominations and speed the approval process.

Management negotiated and successfully defended an entirely new mission to assist in the research of medical defense against chemical agents. The new mission statement for FY 82 will greatly expand USAARL's research responsibilities.

The enlarged and more functional space of the new laboratory facility, which we will occupy in early FY 82, the expansion of the research animal facilities, an increase in hybrid computer capability and full implementation of existing projects along with our expanded mission responsibilities promises to make FY 82 an exciting and challenging year.

USAARL has been operating with the organizational structure shown in the accompanying chart. This chart reflects the functional realignment that was effected in October 1980 and which has been approved by USAMRDC.

# **Support Divisions**

## **Headquarters**

The headquarters group, in addition to the Commander, Deputy Commander and Executive Officer, consists of the Detachment Commander/Adjutant's Office, the Scientific Information Center, and the Resource Management Branch.

## **Office of Detachment Commander/Adjutant**

The office of the Detachment Commander/Adjutant provides command and control functions for all enlisted servicemembers assigned to USAARL. All military personnel actions (officer and enlisted), enlisted disciplinary actions, and mandatory subject training were performed by this office.

This office coordinated all USAARL's administrative functions, provided postal support, and protocol services.

## **Resource Management Branch**

The Resource Management Branch, formerly the Office of the Comptroller, had several major changes during FY 81. Authorization was obtained for a budget analyst and a temporary management assistant. The budget analyst position was filled in September 1981 and action is underway to fill the management assistant position.

The Resource Management Branch staff consists of one supervisory program analyst, one budget analyst, one management assistant, two budget clerks, and one student aide.

The severe funding shortage during the first half of the year and the uncertainty of the occupancy of the new research facility resulted in an erratic funding posture during FY 81. Nevertheless, USAARI conducted its assigned mission and ended the fiscal year with an overall obligation rate of 83 percent.

During FY 81 USAARI underwent an organizational change which realigned manpower positions authorized for two research divisions and created a third research division. This organizational change was necessary to more closely realign research elements under programmatic and professional groupings for execution of the approved mission. The following comparison listing shows only authorized positions; it does not include temporary hires, co-op students, or student aides.

<u>Previous</u> <u>Organizational Element</u>		<u>New</u> <u>Organizational Element</u>	<u>Auth</u>
Office of the Commander	4	No change	4
Comptroller	4	Resources Management Branch	4
Detachment Commander/Adjutant	5	Detachment Commander/Adjutant	5
Detachment	5	Delete	
Scientific Information Center	2	Scientific Information Center	3
Human Tolerance and Surviv- ability Division	46	Sensory Research Division	35
Field Research and Biomedical Applications Division	38	Biomedical Applications Research Division	52
N/A		Biodynamics Research Division	17
Technical and Logistical Services Division	22	Technical and Logistical Services Division	22
Research Systems Division	14	Research Systems Division	14
	158		158

There were no audits or surveys conducted in FY 81; however plans are for USAMRDC to conduct an on-site manpower utilization survey during FY 82.

## Scientific Information Center

The Scientific Information Center's mission was updated and broadened in FY 81 to include responsibility for technology data transfer to other agencies and information services. USAARL's Scientific Information Center serves as the centralized scientific information and reference center for the Army aviation community concerning aeromedical and life sciences research.

During the FY 81 organizational change, the writer-editor's office became part of the Scientific Information Center. Technical editing and writing, public and command information program coordination, exhibit support, and laboratory historical research are provided through this office. The Hometown News program for military personnel was vigorously pursued with 34 releases being submitted during FY 81. Feature articles highlighting the Laboratory's achievements and personnel were published in the post and local area newspapers. The USAARL pictorial history for use in the laboratory facility lobby was an on-going effort planned and coordinated by the writer-editor.

The necessary equipment to add on-line data base capabilities (Lockheed DIALOG and DTIC systems) is on hand and installation awaits the move to the new laboratory facility. This is a needed capability and will be of great help to all USAARL investigators and technicians.

Personnel performed twenty literature searches, provided the Office of The Surgeon General (OTSG) a report on problems of research libraries, reissued USAARL's laboratory notebook policy, and performed a study on library jobbers and vendors for the past five years and submitted it to the OTSG librarian.

Microfiche of the entire collection of Government Reports Index and of all DA, DOD, and civilian personnel regulations including Federal Personnel Manuals and X118 Standards were purchased. This service is updated on a monthly basis and saves manpower by eliminating the time-consuming necessity for posting changes.

Two training seminars in use of on-line data systems were held for researchers, Scientific Information Center personnel, and local librarians.

The FY 82 Affirmative Action Plan and the first statistical analysis of the USAARL workforce were prepared.

## Research Systems Division

The Research Systems Division provides support to the Laboratory in the areas of computer, biomedical engineering, data systems and instrumentation, mathematical and statistical services, and aviation. Major research projects supported during fiscal year 1981 were as follows:

The airborne data acquisition module of the second generation of the Helicopter In-Flight Monitoring System (HIMS II) was completed early in FY 81. Currently, the HIMS can record 22 aircraft parameters and up to 50 user-defined signals, all at programmable sampling rates. A series of training seminars was held for potential users. The laboratory-based data processing system was completed and used to support the Chemical Defense Study. Several hardware, software and operational improvements included:

- (1) Development of a programmable read-only memory (PROM) that loads the boot strap onto the HIMS II. Also, a procedure was developed which enables any program to be put on a PROM to be used with PDP base systems.

- (2) Two interfacing/conditioning circuits were designed and constructed for measurement of body skin temperatures. These circuits, along with other components, were packaged in two units for use with HIMS II and the In-Flight Physiological Data Acquisition System (IFPDAS). Field support for testing occurred during the fourth quarter.

The IFPDAS has the capability to record physiological parameters such as skin temperatures, heart rate, ECG, aircraft intercom, and four user-defined signals. This procured, miniaturized system underwent a long period of debugging and checkout to make it operational.

The existing miniature heads-up display (mini-HUD) interface was updated to allow for simultaneous operation with the HIMS II and to allow for the future expansion to the second phase. This expansion will permit the pilot to view an increased number of aircraft control and performance parameters such as roll, pitch, heading, air speed, altitude, slip and master caution.

A data acquisition system, to support a human response to vehicular firing study, was designed using existing equipment to record six accelerations, time and voice. The study involved measuring head and chest accelerations resulting from vehicular-based firing of 105mm and 155mm rounds. The "subject" for the first test phase in August was a 95th percentile anthropometric dummy. Data analysis was done on the Laboratory SEL/EAI hybrid computer.

Subject response panels were designed and fabricated to be used in conjunction with the Apple II Computer System to support an instructor pilot fatigue study.

The Multi-Axis Vibration System (MAVS) was used to support a visual acuity test, a study of the effect of vibration in a supine seat on selected measures of cardiopulmonary mechanics, and vibration tests on a low-light level camera for the U.S. Army Aviation Board, Ft. Rucker, Ala.

Resource Systems Division completed renovation of all Raydist sites on USAARL's field facility and designed a strobe light system which is activated by tactical frequency modulated radio for night flight location.

The hybrid computer facility was upgraded through the purchase of a high-speed line printer and a movable head disc to triple the printing speed and double the mass storage capacity. FY 81 also saw the completion of a convenient and flexible software system for interactive graphical exploration and evaluation of aeromedical research data.

Phase II of USAARL's Work Measurement Program, a computerized management tool for task and time accounting, was implemented. The system was expanded to include all laboratory personnel for a trial period.

Consultation was provided for the following support projects:

- a. Interfacing a Base II printer to a DEC LST-II computer.
- b. Interfacing a DEC PDP-II computer to the SEL 8500.
- c. Interfacing a DEC LSI-II to a programmable-read-only-memory programmer circuit to produce PROMS for the HIMS II systems.
- d. Analysis of the calibration of drop tower equipment for the crushable carcup program.
- e. Assembly and checkout of a device to provide signals for spatial bandwidth equalization tests.
- f. Installation of strain gauges for measuring pilot control stick forces.

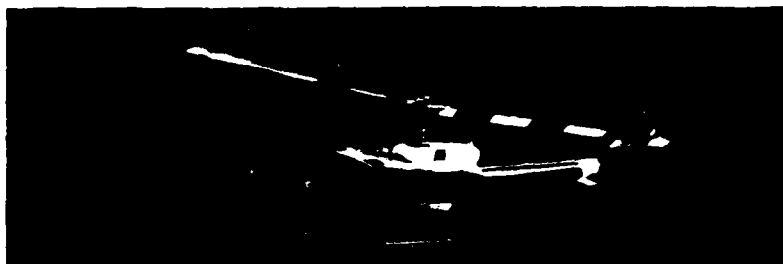
### **Statistical/ Mathematical Support**

Statistical and mathematical activities are often "hidden" or "behind the scenes" activities. Therefore, contributions are or may be incorporated into reports or briefings without necessarily being highly visible.





JU-21G



JUH-1H



JUH-1M



JOH-58A

Assistance was given to the user in the use and interpretation of the General Linear Hypothesis (GLH) model for an unbalanced experimental design. This assistance made it possible for scientists in a study to use the complete set of data available from several sub-studies to analyze data from an unbalanced design.

The results of a time series analysis of the short-term memory data from a 1979 simulator performance study were presented in an in-house report and were the basis for a presentation at the Second Numerical Analysis and Statistical Analysis Conference.

Statistical advice, counsel, or analysis was done or given for the studies: cardiopulmonary function testing in a vibration environment study (design of experiment and exploratory data analysis); analysis of visual performance data from the study of the H57-A and H57-C aircraft; statistical analysis of the visual acuity study data (unequal group sizes) in a vibration environment; regression analyses of the results and/or data from a field test of a Perkins-Elmer machine for measuring  $PO_2$  and  $PCO_2$  with four groups of subjects; design of sample surveys for cardiopulmonary function testing and audiometric testing of Army Aviators..

A guide entitled "Putting Statistics into Scientific Publications: A Guide" was published.

## **Aviation Support**

Fiscal Year 81 saw emphasis placed on management of the training portion of the flying hour program. In FY 80, the monthly training flight hours fell as much as 21% below programmed monthly hours while only 94% of the yearly programmed hours were flown. A monthly variation of less than 15% from the programmed training flight hours was our goal. In FY 81, using a manual management system, 101% of the training hours were flown with a monthly variance of only 12%. A decrease in the monthly variance provides for a more uniform training cycle where aviators receive recurring training instead of training long periods a few times a year. Recurring training helps promote safety and increases pilot capabilities.

A computer program has been written for FY 82 management of the flying hour program. This program tracks flying hours (both re-search and training), computes actual cost per flight hour, reports by exception when aircraft is 10 hours before scheduled maintenance (to assist in scheduling), and provides analysis and projections of flying hours and costs. This system decreases management time and should decrease monthly training hour variance to less than 10%.



Aviation support was provided by the seven assigned MSC research aviators using the capabilities of the diversified types of research aircraft assigned to USAARL. Research application of the JUH-1H provided an airborne platform for continued research on the Integrated Helmet and Display Sight System (IHADSS), Projected Map Display (PMD), testing of chemical defense ensembles, and evaluation of a helicopter oxygen generating system.

Though most of the research flight time was conducted at low altitudes in the highly congested helicopter training area around Fort Rucker, USAARL had another accident-free aviation year. This is largely due to the ready availability of the JOH-58 and its capability of flying as cover aircraft and preventing serious mishaps before they take place.

The JU-21G continued to be used in testing on-board oxygen systems for sustained periods of time at altitudes far in excess of helicopter service ceilings.

Intensified Army management of aviator proficiency drastically increased aviator training requirements. Even with this increase in aviator training requirements, USAARL aviators provided 61 hours more of research flying than in FY 80. Flight hours in FY 81 were research hours 841, training hours 418, for a total of 1,259 flight hours.

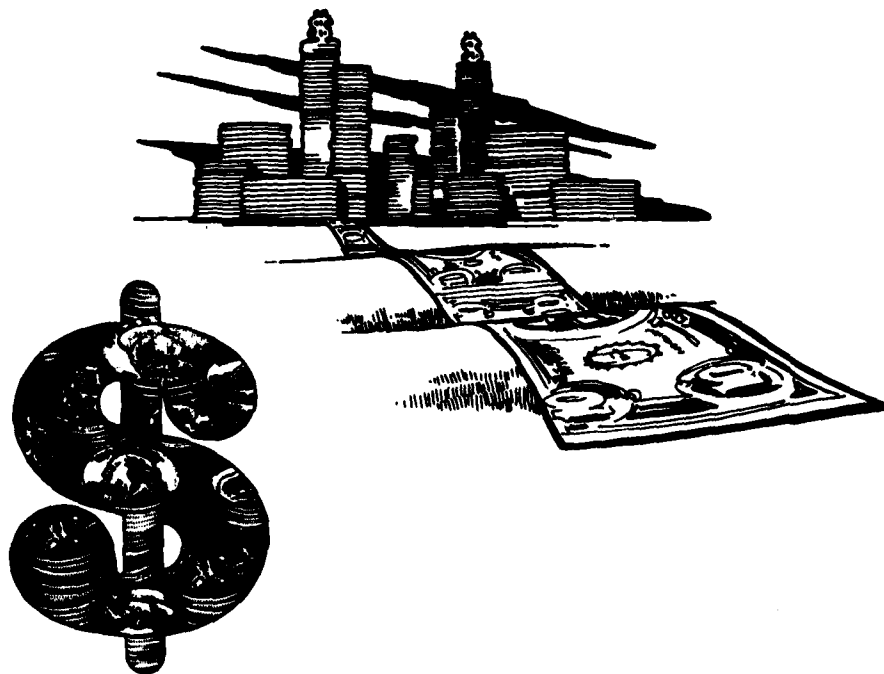
## Technical and Logistical Services Division

The Technical and Logistical Services Division provides total support programs for scientific arts, laboratory crafts, maintenance management, supply and acquisition, property management, and facilities management areas.

Requests for supplies and services submitted to T&LS increased significantly during FY 81. These increases were attributed to preparation and monitoring of the new laboratory building and improved support programs for the research effort. FY 81 break out of requested services and supplies was:

Scientific Arts	590	Work Orders
Laboratory Crafts	202	" "
Maintenance	3445	" "
Supply	3120	Orders
Property	3206	Orders Received
Property	854	Items Turned In

T&LS Division continued to monitor construction of the new laboratory facility. The furniture and equipment packages are on hand and ready for installation in the new building.



# **PROGRAM FUNDING FY 79-80-81**

(Thousands of Dollars)

FY Year	6.1 Research	6.2 Development	6.5 Management Support	Reimbursable	Total
79	725.0	1984.0	450.0	662.1	3821.1
80	421.1	2120.2	110.8	467.8	3119.9
81	713.0	2607.0	49.0	615.0	3984.0

# Funding

## Customer-Funded Projects

Customer-funded projects foster a sharing situation. They are a complementary effort to our established scientific research programs. Designers and developers buy our expertise in areas where they normally do not have the scientific manpower to accomplish a specific scientific task; for example, vision related research. We perform the research, accumulate the data, and provide a real product in terms of data and letter reports. We increase our scientific data base as we supply the information sought by the designers and developers.

There were six customer-funded projects in FY 81. Four of the projects were carried forward from FY 81, and two were new projects. Three of those that were from FY 80 were completed in FY 81. The projects, funding agency, and a brief progress report are given.

**Title** Aviator Workload/Performance Assessment in Support of Advanced Attack Helicopter (AAH)

**FUNDED BY:** AAH-64 Project Manager, Aviation Research and Development Command (AVRADCOM)

**INVESTIGATOR:** LT David O. Cote

**Objective** To investigate the physiological and psychological limits of human capability and compatibility with aviator crew stations, crew tasking and consequent cumulative crew workload, stress and fatigue in the YAH-64 and provide data which will point out areas of system design hampering mission effectiveness. To organize and assess aviator performance data with which to determine the navigation performance and procedures for AAH crewmembers.

**Progress** Workload and navigation performance data associated with three navigation systems were collected and analyzed. Results were presented at the annual forum of the American Helicopter Society, May 1981, and to the TRADOC System Manager of attack helicopters, July 1981. The technical report was drafted and should be published in the first quarter of FY 82.

**Title** Health Hazard Assessment and Implications of Whole-Body Vibration Associated with Advanced Combat Vehicle Technology

FUNDED BY: Tank and Automotive Command (TACOM)

INVESTIGATOR: J.C. Johnson, Isaac Behar

**Objective** A multidisciplinary approach will be used to assess the effect of whole-body, low-frequency vibration and noise peculiar to advanced combat vehicles on human visual, vestibular, hearing and musculoskeletal systems. Dynamic characteristics of the High Survivability Test Vehicle-Light (HSTV-L) semi-supine seat will be determined by Fourier transform techniques using instrumented human subjects on the USAARI multi-axis vibration table. Stress and fatigue reactions including neck muscle stress and head coupled vibration will be assessed by standard biochemical and psychophysiologic as well as specialized electromyographic techniques. Dynamic visual acuity and eye fatigue will be studied under multiple conditions of target display head and eye movement and of frequency phase controlled vibration, contrast, and luminance. These effects will be correlated in relation to their relative hazards to acute or chronic injury potential and influence on crew performance, comfort, and efficiency.

**Progress** Work under this program has been completed and a preliminary report submitted. The three research projects used human subjects to determine muscle stress, visual acuity decrements, and changes in cardiopulmonary mechanics due to vibration in a semi-supine seat. The neck muscle stress data was reduced and demonstrated that a significant increase in neck muscle stress occurred in the full supine seat position when the volunteer lifted his head to isolate it from headrest vibration. It was found that visual acuity decrements were greater (1) under high vibration amplitude, (2) for the 44° seat back angle than the 34° position, (3) with the head resting on the head support than raised off it, (4) for low contrast targets than for high contrast, and (5) for rapidly moving targets than for stationary or slowly moving targets. The evaluation of cardiopulmonary mechanics demonstrated that with vibration, cardiac output generally decreases by 10% and minute volume increases. The findings were presented at the Aerospace Medical Association Meeting, the Tri-Service Technical Working Group for Biodynamics, and the International Workshop on Research Methods in Human Motion and Vibration Studies.

**Title** Development of Measurement Techniques for the Medical Assessment of Visually coupled Systems (VCS) Components

**FUNDED BY:** AAH-64 Project Manager, Aviation Research and Development Command (AVRADCOM)

**INVESTIGATOR:** C. E. Rash

**Objective** It is possible to compromise an aviator's safety, physiological performance and his ability to fly when designing and fabricating a visually coupled system (VCS). The VCS hardware must be scrutinized carefully to insure mutual man-machine conformity. The first phase of this study was concerned with the Helmet Mounted Sight (HMS) component of the VCS. The laboratory experiment was conducted to determine aiming and tracking capabilities of aviators using head oriented coupled trackers. The effects of eye dominance, helmet suspension, helmet weighting and target speed on accuracy were investigated. The second phase focuses on the assessment of helmet mounted displays (HMD). Factors such as display color, image quality and size, brightness, contrast and their impact on the visual system of the crewmember and consequent performance will be investigated. From these investigations measurement techniques for the assessment of visually coupled systems will be developed.

**Progress** A brief study was conducted to assess the feasibility of decreasing the transmission of the beam splitter used in the IHADSS in order to effect an increase in the daytime contrast of the IHADSS symbology. It was concluded that a combiner with a lower transmission would be objectionable during periods of decreased ambient light conditions (USAARL LR 81-1-2-1). The study to assess the feasibility of using a photochromic beamsplitter, called a combiner, in the IHADSS found the photochromic combiner not feasible because of the attenuation of the necessary activation energy band by aircraft windscreens. (USAARL LR 81-7-2-6).

A modeling program which calculates various display Figures-of-Merit has been completed which utilizes a previously acquired data base containing spectral characteristics of various phosphors, visors, combiners, and optical filters. The modeling program was tested on selected HMD configurations and found to be valid. (USAARL Report No. 81-7). These reports complete this project.



**Title** Combat Vehicle Crewman (CVC) Helmet-Impact and Acoustical Evaluation

**FUNDED BY:** US Army Natick Research and Development Command (NARADCOM)

**INVESTIGATOR:** R. Camp; T. Hundley

**Objective** The objective is to develop a combat vehicle crewman (CVC) helmet which provides acoustic and impact protection and high quality voice communication without hearing damage.

The approach is to: (1) measure impulse noise of combat vehicles, (2) establish sound attenuation requirements for adequate protection in CVC environment, (3) establish electro-acoustic characteristics for equipment to assure compliance with hearing conservation requirements, (4) investigate ear-seal configuration for maximum sound attenuation, (5) evaluate impact hazards in combat vehicles and specify design criteria, (6) determine need and design of a suspension and retention system and, (7) determine qualification test procedures.

**Progress** Minimal acceptable real-ear attenuation characteristics were recommended, based on present state-of-the-art technology. Optional methods, including an elastic suspension system incorporated with the CVC earcup, were investigated for improving frequency response characteristics of helmet earphones in the DH-132, DH-140, and SPH-4. Impulse noise data from weapons firings in tanks and combat vehicles were reviewed as part of an on-going effort to characterize the noise hazard profiles encountered in combat vehicles. Crash protection criteria for a US Army motorcyclist's helmet were developed (USAARL LR-81-2-4-1, Medical Design Criteria for US Army Motorcyclist's Helmet").

**Title** US Coast Guard Scan Behavior During Search and Rescue Operations

**FUNDED BY:** US Coast Guard Research and Development Center

**INVESTIGATOR:** Ronald R. Simmons

**Objective** A joint laboratory project was initiated to determine the role of eye movements/performance of US Coast Guard lookouts/scanners during dynamic search and rescue operations. The specific objectives of the investigation included: (1) determine the portion of time that lookouts/scanners actually spent on visual search; (2) determine the patterns of eye movement, eye fixations, and head movement used by experienced versus novice lookouts/scanners; (3) investigate eye movements and lookout response just prior to target detection; and (4) correlate scanning patterns with target detections as a measure of lookout effectiveness.

**Progress** The USAARL visual tracking systems were modified and tested under the harsh sea environments during November and December. The investigation's data collection started in January 1981 and continued through February 1981. Visual data were collected from 16 aircrewmembers in a HH-3F helicopter, 12 lookouts aboard an 82-foot cutter, and 15 lookouts aboard a 210-foot cutter. The resulting data films were processed; the data entered into the laboratory's computer via the NACRS data reduction system and analyzed. The final results are currently being reviewed and a report is in progress. The final report to the US Coast Guard is due December 1981 and will complete this project.

**Title** Night Vision Goggles Attitude Display Concept Evaluation Program, Phase II

**FUNDED BY:** Directorate of Combat Developments

**INVESTIGATORS:** Bruce E. Hamilton and Ronald R. Simmons

**Objective** A Letter of Agreement (LOA) was signed during June 1981 which committed the Naval Air Systems Command (NAVAIRSYSCOM) and USAARL to conduct joint research, funded by the Directorate of Combat Developments (DCD), on a heads-up display with dynamic attitude indicator, integrated with night vision goggles. The research would evaluate the effectiveness of new display technology and focus upon determining whether or not the heads-up display could effectively be used by pilots. Crucial to this evaluation is the quantitative documentation of changes in pilot workload as a function of the heads-up display when used in various flight environments.

**Progress** A protocol for testing has been drafted by USAARL and been given tentative approval by the three organizations involved. The progress of the contractor's efforts has been monitored and delivery of the display is scheduled for December 1981. Testing will begin in January 1982 with a final report due in December 1982.

## Contracts

The comprehensive extramural contract program contributes to USAARL's established scientific programs. In FY 81 one contract was completed, one cancelled, three terminated, and three new contracts were let. Eight existing contracts will continue into FY 82.

**Title** Auditory and Non-Auditory Effects of Exposure to Low Frequency Noise

CONTRACT NO: DAMD17-79-C-9180, Accession No. DAOG 1825

CONTRACTOR: Department of Otolaryngology, Medical University of South Carolina, 171 Ashley Ave, Charleston, South Carolina

INVESTIGATOR: John H. Mills

**Objective** The determination of the extent and frequency region of auditory temporary threshold shifts in humans from exposure to low-frequency noise as well as an indication of the role which will be reflected by elevated cortisol, epinephrine, norepinephrine, and blood pressure levels.

**Progress** A study of low-frequency noise effects in humans has shown that temporary threshold shifts (TTS) were greater between 550-700 Hz, regardless of the octave-band center frequency (63, 125, or 250 Hz). Exposure to 90 dBA for 8 hours produced larger TTS than 84 dBA for 24 hours. Time to recovery from TTS was related to duration of the exposure. Non-auditory effects of the noise exposures included small changes in serum cortisol, heart rate, blood pressure, and catecholamine levels. Contract is complete and report has been submitted.

**Title** Research and Development of Cochlear Microphonic Response to Low Frequency Noise

CONTRACT NO: DAMD17-78-C-8067, Accession No. DAOC 7886

CONTRACTOR: University of Florida, Gainesville, Florida

INVESTIGATOR: Donald Teas

**Objective** Many military vehicles, particularly those found in armor, produce high intensity noise which is predominately low-frequency. The objective of this study is to explore the mechanism of noise induced hearing loss exposure to high intensity, low frequency noise.

**Progress** Normative data in chinchillas have been collected on round window neural potential, individual nerve fiber thresholds, tuning characteristics and input-output functions in response to various noise patterns. In turn, these neural functions have been used to examine the effects of narrow band noise and low-frequency noise in masking paradigms. Work has progressed in the development of instrumentation for generating higher levels of low-frequency noise. Modified surgical procedures have been developed to prevent cerebellar edema during microelectrode recording sessions.

**Title** Effects of Visibility

CONTRACT NO: DABT01-79-C-0312-1

CONTRACTOR: Institute of Medical Sciences, Smith-Kettlewell  
Institute of Visual Sciences, 2200 Webster St.,  
San Francisco, California

INVESTIGATOR: Anthony J. Adams  
Gunilla Haegerstrom-Portnoy

**Objective** Investigate spatial, temporal and retinal eccentricity effects on visibility in the dark-adapted eye.

**Progress** Experiments have been completed on the detection and resolution of peripherally presorted targets, as may be encountered in field situations. A study of the effects of target velocity on retinal summation showed that for any given retinal location, summation, at threshold, occurs over rather long times (at least 500 m/sec for detection and longer for resolution). An investigation of detection of multiple targets in the peripheral retina revealed that for detection of small targets, two targets in close proximity in time augment detection, as expected; but unexpectedly, it was found that this augmentation at threshold occurs over a very large spatial extent.

**Title** Simula II, Crushable Earcup Development

CONTRACT NO. DABT01-79-C-2050-1

CONTRACTOR: Simula Inc., 2223 S. 48th St., Tempe, Arizona

INVESTIGATOR: Stanley P. Desjardins

**Objective** To develop and evaluate crashworthy (crushable) earcups for the SPH-4 Army aircrewman helmet.

**Progress** A total of 14 prototype earcups were produced. Noise attenuation tests on the prototype were satisfactory. Inert mass impact tests revealed adequate "crushability." Impact tests with human surrogates are on-going. The contract was terminated.

**Title** Material Characteristics

CONTRACT NO: DABT01-79-C-045-1

CONTRACTOR: Auburn University, Auburn, Alabama

INVESTIGATOR: Warton Jemian

**Objective** Research into the optimum characteristics of materials for head protection during impact.

**Progress** A final report was reviewed and accepted and the contract was terminated. The report revealed an advantage to the use of graphite fiber reinforced helmet shells. The graphite adds stiffness to the shell at less weight than fiberglass. Unfortunately, the report

does not discuss the feasibility and cost of shell production with this new material. The report provides an unvalidated design procedure for helmet shell and energy-absorbing liner selection; thus, the procedure is useful only to obtain a general idea of the trade-offs involved.

**Title** Multiaxis Impact Experiment on Volunteers

CONTRACT NO: ARL-MIPR-2-79 (DD448)

CONTRACTOR: Naval Biodynamics Laboratory (Was USN Aerospace Med Research Laboratory, Pensacola, Florida.

INVESTIGATOR: Channing Ewing

**Objective** This Army-Navy project was undertaken to measure the kinematic response of critical anatomical parts of volunteers subjected to impact.

**Progress** Project funding was not available. No further work was done. Contract was terminated.

**Title** Mechanisms of Human Injury

CONTRACT NO: AR-11-79 (DA25-44)

CONTRACTOR Wayne State University, Dayton, Ohio

INVESTIGATOR: Albert King

**Objective** The executive agent for this tri-service study is the US Air Force Aerospace Medical Laboratory, Wright Patterson Air Force Base, Ohio. The objective is to determine mechanisms of injury when deceleration is applied to human surrogates in UH-60 energy-absorbing pilot seats. Overall, this work supports the tri-service human tolerance investigation.

**Progress** Twelve human surrogate impacts have been completed. The tests resulted in spinal column fractures for a majority of the specimens. The Air Force is comparing the bone strength of the specimens to a normal flying population. Further work is planned for FY 82 by the FAA and the US Army Technology Laboratories. USAARL will monitor the project and assist in analysis of the data.

**Title** Evaluation of Inner Ears (Chinchillas) for Loss of Sensory Cells Using a Surface Preparation Histology Technique

CONTRACT NO: DAMD17-78-C-80019, Accession No. DA00 7888

CONTRACTOR: Syracuse University, Syracuse, New York

INVESTIGATOR: Roger P. Hamernik

**Objective** To determine extent of damage to the cochlea from noise exposure.

**Progress** Forty cochleas from chinchillas exposed to hazardous impulse noise have been histologically prepared and evaluated for ultrastructural damage (hair cell loss). In addition, selected cochleas were evaluated by means of scanning electron microscopy. Efforts were completed to develop a fixation buffer suitable for preparing tissue samples for both scanning and transmission electron microscopy.

**Title** Effects of Hearing Protectors on Human Auditory Localization

CONTRACT NO: DAMD17-80-C-0131, Accession No. DAOG 3438

CONTRACTOR: Florida State University, Tallahassee, Florida

INVESTIGATOR: L. F. Elfner

**Objective** Current military weapons such as the M198 VIPER and the M109 produce blast overpressure which require combinations of hearing protectors. The contract will develop methods to determine the effects of these protectors on the ability of the soldiers to localize sounds. The localization of sound is considered essential to safety and operational effectiveness. Results of this study will have direct implications for improved protector design and provide a methodology to be used throughout development of future hearing protective devices for use around Army weapons.

**Progress** A prototype system has been developed for random presentation of acoustic stimuli from variable azimuths. A systematic review of the scientific literature related to auditory localization has been developed for data acquisition and control of subjects' head orientation. Preliminary localization data collected with human volunteers suggest that helmets with built-in ear muffs degrade auditory localization in the horizontal plane, especially with the helmet's active hearing protection circuitry on.

**Title** Blast Trauma: The Effects on Hearing

CONTRACT NO: DAMD17-80-C-0133, Accession No. DAOG 5620

CONTRACTOR: Callier Center for Communication Disorders,  
University of Texas, University of Texas  
Dallas, Richardson, Texas 75080

INVESTIGATOR: Roger P. Hamernik

**Objective** The objective of this study is to extend our basic knowledge of the nature of injury to the hearing receptors resulting from exposure to impulsive sounds (blast overpressure). Army weapons systems produce impulse noise which may be hazardous to hearing. Our

current data base from which to assess the hazard is inadequate. The results of this study will contribute to that data base by providing new information about the nature of the injury.

**Progress** Basic instrumentation for stimulus generation and control, animal training, and histological processing has been assembled and tested. Development of a single neural unit recording laboratory, including acquisition and programming of a computer system, has been initiated. Psychophysical tuning curves (PTCs) obtained with chinchillas have been shown to be similar to human PTCs and similar to chinchilla neural tuning curves. Work has begun to assess the effect of blast waves on PTCs. Cochleas from chinchillas exposed to laboratory-generated blast waves have been examined microscopically for loss of hair cells and changes in cochlear supporting cells.

**Title** Spatial-Temporal Resolution of Local and Extended Stimuli in the Human Visual System

CONTRACT NO: DAMD17-77-C-7007, Accession No. DAOC 7888

CONTRACTOR: Texas Tech University School of Medicine,  
Lubbock, Texas

INVESTIGATOR: Perry Speros

**Objective** This research project was aimed at identifying through psychophysical techniques the sensitivity and spatial characteristics of sustained and transient neural mechanisms under different stimulus conditions.

**Progress** This project was terminated following Dr. Speros' transfer to Baylor School of Medicine. Due to a change in research priorities, this contract was not renewed at Baylor.

**Title** Study for Vibration Effects on Muscular Performance

CONTRACT NO: DAMD17-80-C-0054, Accession No. DAOG 2591

CONTRACTOR: University of Miami, Department of Industrial  
Engineering, Coral Gables, Florida

INVESTIGATOR: Carl Greco

**Objective** This research is required to determine the effect of indirect vibration in fine muscular control, the frequencies and magnitude of vibration most detrimental to fine muscular control, and the correlation between fatigue induced changes in electromyographic data and fatigue induced decrement in fine muscle performance during tracking.

**Progress** Interaction of control handle mechanical vibration and human operator tracking performance was investigated during four separate tests in five subjects. Tracking scores were recorded during (1) random vibration and non-vibration sequences, (2) selected frequencies of sinusoidal vibration, (3) selected magnitudes of random vibration, and (4) prior to and following muscle fatigue. Compensatory tracking was employed throughout the study with a random, band-limited (0-1 Hz) target signal. The control handle pivoted about the subject's wrist in the horizontal plane with maximum rotation constrained to be within the normal anatomical range. Bidirectional rotational vibration was applied to the handle in addition to unidirectional torque. Random vibration was band limited between 5-200 Hz.

According to initial conclusions, mechanical random vibration (1g) of the control handle did not increase tracking error. Contract completed.

**Title** Effect of U.S. Army Headgear Parameters on Neck Muscle Loading and Fatigue

CONTRACT NO: DAMD17-80-C-0089 Accession No. DAOG 2957

CONTRACTOR: Wright State University, Department of Biomedical Engineering, Dayton, Ohio

INVESTIGATOR: Chandler A. Phillips

**Objective** Pure isometric exercise is commonly used during postural adjustments such as the neck muscles holding the head (and helmet) erect during (1) flying (and tracking) activity, and (2) driving (and tracking) activity in armored vehicles. Since helmet design influences the onset and recovery from isometric cervical (neck) muscle fatigue, the need exists to objectively quantify both load on the neck as well as fatigue "end-point." The purpose of this experiment is to compare how different helmet designs (PASGT-Infantry, PASGT-Airborne, CVC and SPH-4) load the cervical muscles and affect fatigue end-point. The maximal voluntary contraction (MVC) of two different cervical muscles (trapezius and sternocleidomastoid) are measured under isometric conditions. Experiments are then performed to set the length of time that prescribed contraction patterns (lateral rotation, dorsiflexion, and both alternately) must be performed to predict and set accurately the endurance times and to set accurately the rest interval between the contraction patterns so that the muscle is not fatigued during a second (and subsequent brief) contraction pattern in each series for each helmet type. Adequate safeguards are followed to minimize "training effect" in untrained subjects.

**Progress** The university has completed the contract work and has received funding for continuation work. The work has shown that strength endurance relationship for neck muscles to sustain isometric contractions at low isometric tensions was substantially higher during lateral and dorsal contractions than with ventral



contractions. Lateral neck contraction modes almost double the endurance of forward neck contraction modes to sustain isometric loading. This study would seem to show that, if asymmetric loading must be imposed, the preferred method of loading would probably be on the front or sides of the helmet with a minimum weight on the back of the helmet. This then would allow the pilot to take physiological advantage of the increased endurance of the muscles involved with lateral and dorsal flexion of the head and thereby increase his tolerance to muscle fatigue.

This study confirms that the characteristic changes in EMG associated with isometric muscle fatigue of the limbs of the body (a 75-80% increase in the amplitude of the EMG, and a 25-30% decrease in the center frequency of the EMG) are also applicable to the neck muscles. With both contraction modes and exercise periods, and independent of head loading configuration, the isometric strength of the neck muscles does not appear to fully recover within the 35-minute rest interval employed.

A study of the "essential equivalency" of the variable CG-weight (VCGW) helmet set to model the combination SPH-4 helmet with night vision goggles (H/NVG) and the actual H/NVG combination has been demonstrated by this study. The endurance times for the VCGW were 20-30% lower (on an average) than those found for H/NVG. This discrepancy is not believed to be due to differences in the helmets; rather, it is believed to be the result of differences in the extent to pre-trial exposure and training given the subjects wearing the two types of helmets.

The second year continuation of this study will focus on generic variable CG-weight distribution in order to specify tolerances in helmet design. The continuation is starting with an extensive (4-6 week) training period using the VCGW helmet set to model the H/NVG combination. The investigators fully anticipate that this will remove "training effect" differences (as well as develop reproducibility for each subject) so that endurance times for the new subject population should match very closely that observed for the H/NVG combination of the previous subject population.

**Title** Statistical Analysis of Visual Performance of Helicopter Pilots During Instrument Flight on Repeated Flights

CONTRACT NO: DAMD 17-81-C-1174, Accession No. DAOG 7500

CONTRACTOR: Jacksonville State University, Jacksonville, Alabama

INVESTIGATOR: T. A. Smith

**Objective** Identifying, analyzing, and defining Army aircrew visual workload parameters during various tactical mission requirements is critical in optimizing man's capabilities in military airborne operations. The objective of this project is to develop the statistical

methodology to analyze visual performance measures collected via the corneal reflection technique. Special emphasis will be placed on specific analysis of visual performance data collected at USAARL during a helicopter simulated sustained operations project.

**Progress** New start as of Aug 81. No progress report. However, the visual performance data have been collected and reduced and are available for the university.

**Title** A Finite-Element Model Analysis of the Protection Provided by Army Aviator Helmets to the Human Head and Neck

CONTRACT NO: DAMD 17-81-C-1186, Accession No. DAOG 7442

CONTRACTOR: University of Iowa, 1214 Engineering Bldg,  
Iowa City, Iowa

INVESTIGATOR: Y. K. Liu

**Objective** To develop a method to assess the probability of head and/or neck injury for a specified input pulse to a helmeted head.

**Progress** New start as of Aug 81. No progress report.

**Title** Modification of Anthropomorphic Dummies for Spinal Load Measurement and Support of Testing

CONTRACT NO: DAMD 17-81-C-1175, Accession No. DAOG 7477

CONTRACTOR: Simula, Incorporated, 2223 S. 48th Street,  
Tempe, Arizona

INVESTIGATOR: Stanley P. Desjardins

**Objective** To simulate previous human cadaver tests with instrumented dummies for comparability. This work will provide a method of relating dummy tests to injury mechanisms found in cadaver tests.

**Progress** New start as of Aug 81. No progress report.



### PERSONNEL STRENGTH

			CIVILIAN		CO-OP	STUDENT	
FY 79	OFFICER	EM	PERM/TEMP		STUDENT	AIDS	TOTAL
AUTHORIZED	31	46	65	0	0		142
ACTUAL	29*	40**	55	8	9		143
FY 80							
AUTHORIZED	30	47	59	6	0		142
ACTUAL	42**	57	3		9		135
FY 81							
AUTHORIZED	30	47	61	12	0	0	150
ACTUAL	28*	48**	56	6	6	4	148

\*Includes one Navy Officer

\*\*Includes one Air Force Sergeant

## Personnel

The educational and skill levels of the Laboratory's assigned personnel are continually increasing. These increases come through assignment of highly qualified new personnel, completion of some long-term educational goals by others, and through the initiative and personal determination of those who pursue after-duty study. An important element in increasing the skills and knowledge of USAARL Personnel is their participation in correspondence courses.

Training is a vital element in maintaining and improving the proficiency of assigned personnel. Six military and 41 civilians received training and professional development during FY 81. In addition, such training experiences as professional conferences, seminars and short courses benefited 12 people.

Among the laboratory's professional personnel there are 22 doctorate, 14 master, and 33 bachelor degrees.

Mandatory training requirements were met by all military personnel. In the skills qualification testing for FY 81 USAARL military personnel had a 92 percent pass rate. Ten persons reenlisted or extended their enlistment for a total of 38.5 years.

A Navy officer and an Air Force NCO are on assignment to USAARL to work in areas considered vital to the Navy and Air Force but not being duplicated in their own laboratories.

## Co-op Program

The cooperative education program is an established and thriving endeavor at USAARL. The uncertainties, the growing pains are behind us and tangible results can be seen--results benefiting both USAARL and the students. During FY 81, 18 co-op students were part of USAARL's program.



In FY 81 an electrical engineering co-op student designed and developed an aviator helmet tester device. The small, portable device is easy to use and has been approved for local use. When the device was approved for local use, the student received a cash award for his initiative and imagination. Benefits go both ways.

Two co-op graduate students took active roles as technicians in ongoing research projects. The research activities and the data from these USAARL research projects will be the basis for their master's thesis.

A tri-fold Co-op Information pamphlet was published this year. The handy, concise pamphlet has helped spread the word about the opportunities available through the Army's cooperative education efforts.

## **Worker Trainee Program**

USAARL has two worker-trainees in permanent clerical positions and employs "on loan" an additional worker. Since USAARL became a participant in the program in May 1980, supervisors have been monitoring and guiding the training of these employees. These three worker-trainees have completed on-the-job and classroom training and moved from the GS-1 entry level to the GS-2 or GS-3 level, depending upon their clerical proficiency.

## **O1H Program**

The recruiting of biological sciences assistants (O1H) to fill vacant slots within USAMRDC received major emphasis in the first half of FY 81. In December of 1980 USAMRDC had 172 authorized slots and 162 or 94% of the authorized O1H personnel assigned. USAARL had 10 authorized O1H positions and they were all filled as of Dec 1980.

The inter-laboratory coordinated effort by the command and individual laboratories to obtain biological sciences assistants through college recruitment has gradually decreased. Reclassification of active duty enlisted members into the O1H MOS remains the most effective avenue for recruiting O1H personnel.

An O1H survey was conducted and the results were used to develop information on the effectiveness of the O1H program and to identify problem areas and possible improvements in the career progression patterns. These results were also used in a June 1981 staff study which addressed retention problems and career management procedures for O1H MOS programs.



## **Mobilization Designee (MOBDES) Program**

The MOBDES program, which facilitates rapid expansion of the U.S. Army Medical Research and Development Command by preassignment of selected U. S. Army Research (USAR) officers, is designed to use the designee's scientific and administrative capabilities during peace time. The USAARL program includes allied science officers, medical officers, aviators and combat arms officers.

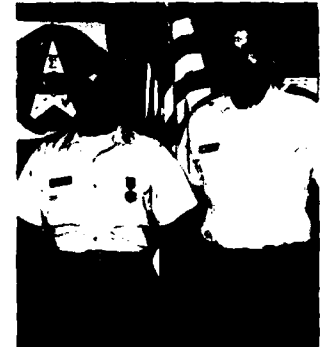
The USAARL MOBDES program has fifteen designee positions. Half of our designee positions are filled and many of the designees have completed second terms. They have made significant contributions to the research program.

## **Affirmative Action**

Measures to further affirmative action continue to receive primary emphasis at USAARL. Cooperative efforts between USAARL and Ft Rucker in the co-op program, in the worker-trainee program, and in the use of upward mobility positions move USAARL forward in its affirmative action goals.

USAARL's affirmative action plan ties in with and sets goals that complement and reflect those of Ft Rucker.





## Personnel Achievements

### Civilian Awards

#### No. Presented

Meritorious Civilian Services Award	1
Outstanding Performance	29
Quality Step Increase	1
Special Service Award	2

### Military Awards

Meritorious Service Medal	7
Army Commendation Medal	5
Army Achievement Medal	1
DA Certificate of Achievement	4
USMARDC Certificate of Achievement	1

### Promotions

Officer	4
Enlisted	14
Civilian	
Permanent	15
Temporary	4
Co-op Students	10

## **Special Recognition**

USAARL Soldier of the Year

SP5 Leon Kaylor

Completed Command and General Staff College

MAJ Chester Duncan

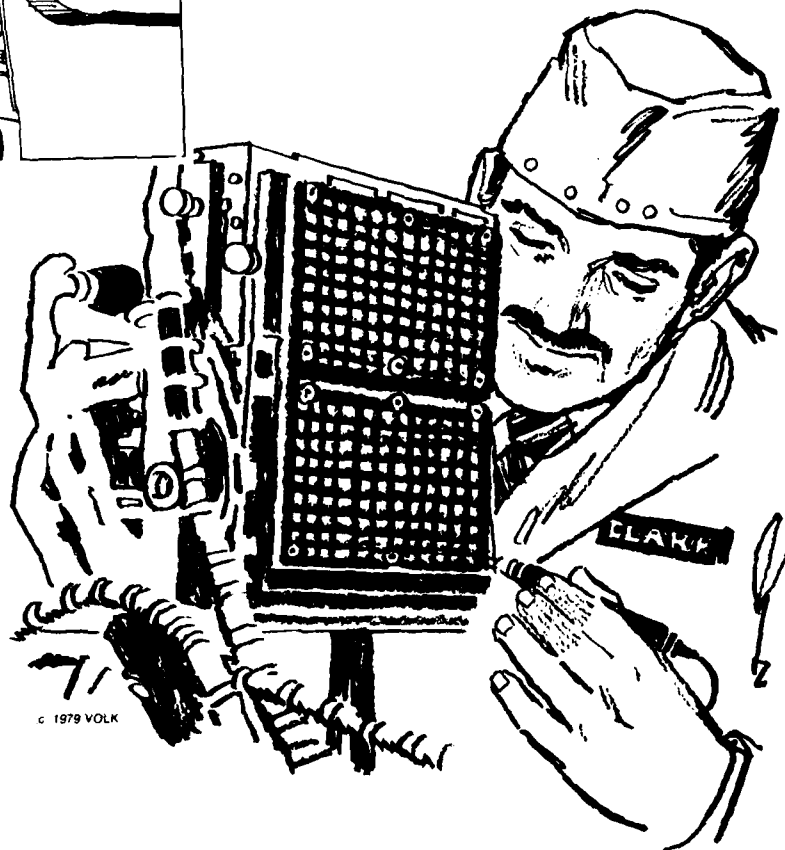
MAJ Ruben Pinkson

CPT Gerald Nagel

## USAARL'S New Facility

This has been a long year as USAARL employees rode a tide of anticipation as a building acceptance date neared and then was adjusted. The structure looked marvelous all through 1981 and it was difficult to understand that those items which could not be seen were more important to future research efforts than the facade. Equipment has been packed and unpacked, project start dates pushed forward and expectations have surged and waned. But, as we said last year: "Soon, soon we'll be in the new laboratory."





# Scientific Programs

USAARL's scientific research comes under four of the U.S. Army Medical Research and Development Command's major research areas. Under each of these research areas, USAARL has an established scientific program or programs. A scientific program will involve one or more individual projects documented by a DD Form 1498. This is a convenient system for grouping the work we do and it makes it easier to trace the compliance with USAMRDC guidelines.

Only one new project was begun in FY 81 and that involved USAARL's entry into a fourth research area, Soldier Chemical Warfare Agent Antidote Development.

The research areas and the DD Forms 1498 that pertain to them are as follows:

TITLE	DA ACCESSION NUMBER	PROGRAM ELEMENT, TASK AREA, WORK UNIT
SYSTEMS HEALTH HAZARD RESEARCH AREA		
Physiology and Psychophysics of Information Transfer in the Visual System	DAOG 5999	6.11.02.A CB 285
Military Acoustic Hazards: Mechanisms of Hearing Loss	DAOB 6889	6.11.02.A CB 282
Biodynamics of Impact Physiology	DAOD 6735	6.27.77.A AG 137
HAZARDS OF MECHANICAL FORCES RESEARCH AREA		
Auditory Effects of Blast Overpressure	DAOG 5998	6.27.77.A AA 136
Medical Assessment of Hear- ing Protective Devices	DAOB 6886	6.27.77.A AA 135

TITLE	DA ACCESSION NUMBER	PROGRAM ELEMENT, TASK AREA, WORK UNIT
Biodynamics of Life Support Equipment and Personnel Armor	DAOG 0167	6.27.77.A AG 131
Vibration Hazards of Combat Aircraft and Vehicles	DAOG 6100	6.27.77.A AD 132
Biomedical Application and Health Hazard Assessment of Oxygen Enrichment Breathing Systems	DAOG 0169	6.27.77.A BI 168
Research Countermeasures for Significant Medical Hazards in Military Systems	DAOG 0165	6.27.77.A BI 167
COMBAT CREW EFFECTIVENESS RESEARCH AREA		
Military Visual Problems: Assessment, Mechanisms, and Protection	DAOB 6893	6.27.77.A BG 164
Assessment of Visual Perfor- mance Based Upon New Know- ledge of Retinal Function	DAOG 1490	6.11.01.A 00 278
Anthropometric Criteria for Army Aviators	DAOG 6102	6.27.77.A BH 166
Aeromedical Research of Oper- ationally Significant Prob- lems in the Army Aviation Environment	DAOG 0151	6.27.77.A BH 165
Visual Performance Research Related to Operational Problems in Army Aviation	DAOG 0156	6.27.77.A BH 162
Cardiopulmonary Physiology in Army Aviators	DAOG 1505	6.11.01.A 00 279
Research Directed at Bio- medical Parameters Affecting Aircrew Workload During Sustained Operations	DAOG 0153	6.27.77.A BH 161
Parametric, Multimodal Work- load Assessment in Aircraft Guidance Systems	DAOG 6101	6.27.77.A BH 163

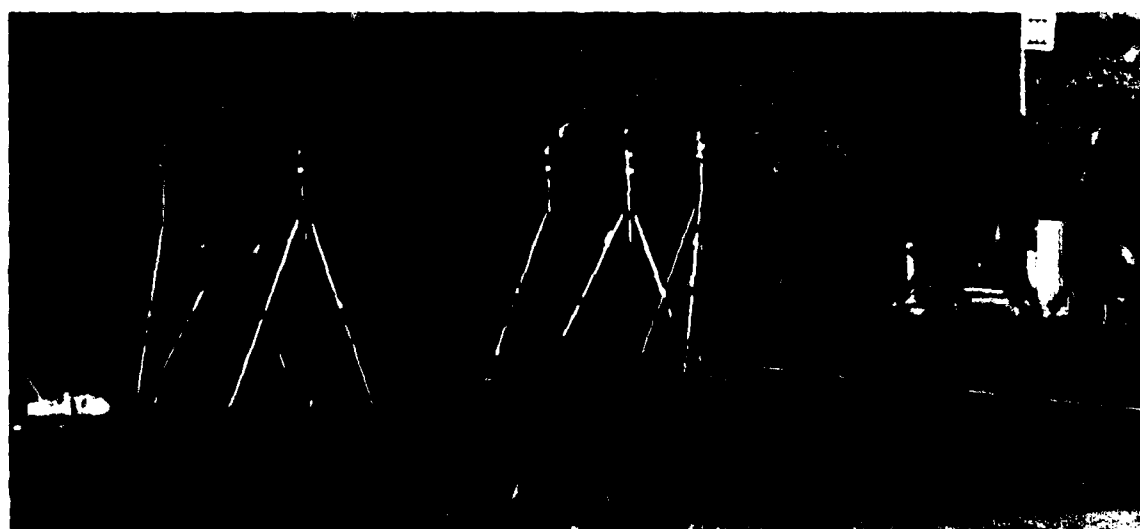
TITLE	DA ACCESSION NUMBER	PROGRAM ELEMENT, TASK AREA, WORK UNIT
SOLDIER CHEMICAL WARFARE AGENT ANTIDOTE RESEARCH AREA		
Antidote and Antidote/Agent Effects on the Visual System	DAOG 8399	6.27.34.A AO 381
Effects of Nerve-Agent Anti- dotes on the Visual System	DAOG 1506	6.11.01.A 00 277





# **Systems Health Hazard Research Area**

This basic research project area principally involves the development of the minimum biological and biomedical data bases necessary and sufficient to protect personnel from hazards generated by Army systems, combat operations and work environments. Research efforts are directed toward those physiological and biomedical technology bases which provide the foundation for the more applied USAARL research programs addressing military systems and operations presenting potential health hazards. Investigations in this program include studies to provide quantitative information on the physiological processes and mechanisms subserving visual perception, studies to determine the physiological mechanisms of auditory injury from noise, vibration, and chemicals, and studies to determine bone, joint, and tissue response to vibration and blunt trauma.



# Visual, Auditory and Vibration/ Impact Physiology Program

**Background** The development, fielding and use of modernized Army weapons, along with new doctrine for combat operations, threaten to subject the modern soldier to forces and demands which exceed his biological limitations. For example, the fact that one out of every three aviation crash fatalities is caused by head and/or neck trauma indicates that aviators are being subjected to mechanical forces which exceed human tolerance/survivability limits. Increased noise levels and exposure profiles for a broad range of weapons will place additional demands on the capability of the human ear to withstand high noise environments and still function adequately. New combat doctrine which places increased priority on night operations and target detection raises questions about soldiers' visual capabilities and effective procedures for maintaining and enhancing them.

The operational questions and problems which arise from new weaponry and doctrine require biomedical technologies and criteria for effective solutions. These technologies and criteria, in turn, demand sufficient biomedical data bases to support applied efforts. In most cases, however, the required data bases are either non-existent or woefully inadequate. Consequently, the need for new biomedical data to support solutions to contemporary and future-oriented problems is substantial. USAARL's basic research program is designed to meet this need.

Obviously, future-oriented Army problems are critical in guiding the basic research program. However, not all of tomorrow's problems and questions are foreseen today. In order to maintain a scientific base capable of addressing unforeseen problems, a proportion of the basic research is non-problem oriented in nature. This serves at least two primary purposes. First, it adds to our knowledge of basic biological principles; and, second, it keeps our scientists abreast of current findings and thinking in biological sciences such that this knowledge may someday be applied to help and protect the individual soldier.

The generic goal of the basic research program is to provide biomedical data bases, along with technical concepts, to support applied research and development efforts of the Laboratory. The

applications for these data bases include damage-risk criteria, medically valid design criteria, medical input to doctrine and tactics, and medically-based technologies. Secondary goals of the program are to maintain professional currency of the scientific staff and to identify new concepts and technologies developed elsewhere with potential value for Army applications.

**Objective** The primary objectives of this research program include developing animal models for the study of visual and auditory function; providing a data base on energy-injury relationships for impulse and steady noise; providing energy-injury data to support development of improved designs for head and whole body impact protection; establishing a valid helmet impact test methodology; determining short term and cumulative effects of vibration on the musculoskeletal system; providing quantitative information on the physiological processes and mechanisms which underlie visual perception; and developing and validating concepts for new methods, techniques and instruments to assess sensory capabilities and degradations.

**Progress** As part of efforts to establish a visual neurophysiology lab, instrumentation for stimulus generation, data acquisition and animal monitoring has been completed. Initiated this year was the staffing and development of a visual neuropharmacology lab which will be used to study putative neurotransmitters within the visual system.

Evaluation was made of an aviation problem in which pilots reported seeing double flashes when, in fact, the source was a single flash. This fast, multiple transient perceptual response to a single flash of light has been defined and quantified.

A study was conducted to determine whether the lack of visual pigment, a congenital defect, played a role in susceptibility to noise induced hearing loss. Preliminary analysis of data shows no major relationship between potential hearing loss and quantity of pigmentation.

A biologically valid test methodology for evaluating helmet protection is nearly complete. Further evaluation was performed on energy absorbing polyurethane foam and different shells for head protection. Work has begun on evaluation of secondary injury potential of body armor.

PUBLICATIONS: *Biochemical Analysis of Synovial Fluid from Vibrated Swine*, USAARL LR 81-5-2-4

*Medical Design Criteria for U.S. Army Motorcyclist's Helmets*, USAARL LR 81-2-4-1

PRESENTATIONS:

*Impact and Vibration Testing of a Modified CH-1 Crew Seat*, presented to Aerospace Medical Association, May 81 (Proceedings, p. 215).

*United States Army Flight Helmet Performance*, presented to Aerospace Medical Association, May 81 (Proceedings, p. 559).

*Hearing Impaired Aviators in the Civilian*, presented to ASME Meeting (AGME), April 81.

**DD 1498**

This work was conducted under three Research and Technology Work Unit Summaries.

Physiology and Psychophysics of Information Transfer in the Visual System, DAOG 5999, Work Unit 277.

Military Acoustic Hazards: Mechanisms of Hearing Loss, DAOB 6889, Work Unit 282.

Biodynamics of Impact Physiology, DAOG 6782, 157.

**Contributing Work**

One customer-funded and seven contract projects contributed to the research objectives of this program.

Combat Vehicle Crewman (CVC) Helmet Impact and Acoustical Evaluation.

Mechanisms of Human Injury.

Effects of Hearing Protectors on Human Auditory Localization.

Evaluation of Inner Ear (Cochlea) Hair Loss of Sensory Cells Using a Surface Preparation Histology Technique.

Auditory and Non-auditory Effects of Exposure to Low Frequency Noise.

Research and Development of Cochlear Microphonic Response to Low Frequency Noise.

A Finite-Element Model Analysis of the Protection Provided by Army Aviator Helmets to the Human Head and Neck.

Modification of Anthropomorphic Dummies for Spinal Load Measurement and Support of Testing.



## Hazards of Mechanical Forces Research Area

Human health threats dealt with in this research area include, but are not limited to, those which are (a) built into weapon systems, b) caused by or accompanying military operations, (c) generated during combat training, (d) inherent to certain microenvironments, and (e) produced by Army industrial operations. Examples include bone degrading vibrations present in armored vehicles, smoke-induced respiratory injury resulting from realistic training or equipment, heat stroke induced by wearing chemical protective suits in hot environments, and hearing loss attributable to artillery weapon noise. Efforts within this project area focus on identification and quantification of the various insults experienced by military and civilian personnel, development of dose-response relationships for each insult, and development of injury prevention and health protection criteria and technologies.



# Auditory Effects of Blast Overpressure Program

**Background** Current Army weapons development efforts aimed at countering Warsaw Pact threat capabilities include improved artillery cannons, anti-tank rockets, and mortars. New artillery cannons and propellant charge are being developed to meet doctrinal requirements for enhanced delivery range, rapid rates of fire, and reduced weight for air mobility. Improved anti-tank rockets with high-energy propellants may be fired from reflective enclosures such as bunkers or covered foxholes. And, mortar technology is being advanced to achieve greater delivery ranges and rapid rates of fire. In each of these families of weapons, dangerously high levels of blast overpressure are a by-product of advancing weapons technology.

The high levels of blast overpressure which will be commonplace on the modern battlefield pose potentially serious health hazards to soldier/operators. Air-containing organs such as the ear are particularly susceptible to injury, with serious medical consequences possible. Hearing loss, even temporary, among troops using blast-producing weapons can degrade critical soldier-machine performance, endanger effective command, control and communications, and disrupt critical combat tasks such as detection of the enemy during patrol missions. Hearing loss can thus endanger the soldier's capability to accomplish the combat mission. Further, permanent hearing loss is a cause of substantial disability compensation payments, even under peacetime conditions.

The existing exposure limit for impulse noise (i.e., blast overpressure) is based on a grossly inadequate biomedical data base and on a number of assumptions which have yet to be validated. The physical characteristics of the blast wave which are responsible for injury to the ear have not been completely identified, and the mechanisms of injury within the ear are only poorly understood. Consequently, improvements in protection technologies have been difficult to achieve.

The primary long-range goal of this research program is the establishment of a comprehensive biomedical data base to support the development of a valid damage risk criterion. A secondary long-range goal is the development of technology, approaches and devices

with potential for improved protection against blast-induced hearing loss. A significant short-range goal is the direct validation of the adequacy of state-of-the-art hearing protective devices for critical developmental systems.

**Objective** The major technical objectives include quantitative analysis of the physical characteristics of blast waves, development and validation of a large animal model for studying auditory injury, development of laboratory impulse noise exposure capabilities where pressure wave characteristics can be systematically varied, systematic animal studies to determine the relationship between physical parameters of blast waves and auditory injury, development and validation of mathematical models to assess the effects of protective devices on effective impulse noise exposure, and development and validation of generalized impulse noise exposure criteria. Further, technical objectives include identification of the mechanisms underlying blast-induced hearing loss, identification of susceptibility factors pre-disposing individuals to blast-induced hearing loss, and development and validation of mathematical models for predicting blast-induced hearing loss.

**Progress** A field study to directly validate the adequacy of state-of-the-art hearing protection for the VIPLR (a shoulder-fired anti-tank rocket) was completed with 54 volunteers. L-A-R earplugs were found to provide adequate protection for two rounds fired in rapid succession. A preliminary analysis of these data was presented at the meeting of Research Study Group 6 of NATO Panel VIII.

A field study to assess directly the adequacy of L-A-R earplugs for crewmembers firing the M198 (the Army's new 155mm towed howitzer) was initiated. Extensive efforts have been invested in protocol preparation, equipment preparation and calibration, and recruiting of volunteers. Data collection is in progress.

Studies with chinchillas to assess the role of peak pressure in determining impulse noise-induced hearing loss have been completed. Peak pressure was found not to be the major determinant of injury. In addition, the technique of averaging the peak pressures from several exposures was shown to underestimate the actual degree of risk. An abstract has been accepted for presentation of this work at the annual meeting of the Acoustical Society of America.

A mobile audiometric test facility (trailer) has been built. The facility includes sound booths and instrumentation for the automatic testing of four individuals at a time. Proper operation of the test equipment has been verified, and the quality of the test environment has been validated against stringent standards.

PRESENTATION: *Preliminary Results of Direct Determination of the Adequacy of Hearing Protection for Use with the VIPER Anti-tank Weapon, also-- Role of Peak Pressure in Determining Impulse Noise Induced Hearing Loss in Chinchilla*, presented to NATO DRG Panel, Research Study Group 6, Effects of Impulse Noise, May 81.

**DD 1498** The above work was conducted under Research and Technology Work Unit Summary.

Auditory Effects of Blast Overpressure, DAOG 5998, 136.

**Contributing Work** Work done under the following contract contributed to the research objectives of this program.

Blast Trauma: The Effects on Hearing

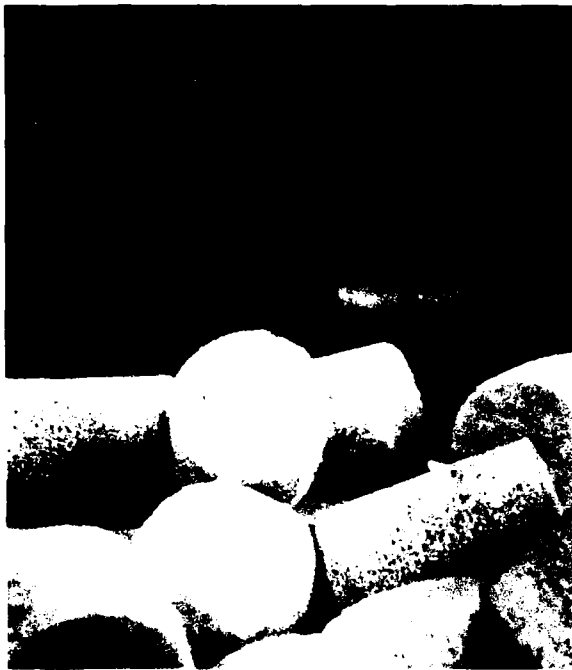
# Noise Hazards of Combat Vehicle Program

**Background** As part of a large-scale modernization program, the Army is developing or fielding advanced design combat vehicles for a wide variety of battlefield applications. Combat doctrine being developed for the battlefield of the future calls for high-speed, lightweight, all-terrain (i.e., tracked) vehicles for fighting and transporting troops, and also for heavily armored, yet high speed tanks with enhanced firepower. Also intended to the high-intensity battlefield of the future will be advanced performance helicopters with advanced design features. Such hardware combinations will generate hazardous levels of both steady noise from engines, sprockets, rotor blades, and the like, and impulse noise from machine guns, cannons, missiles, etc.

Coupled with such advanced hardware will be the requirement for continuous combat operations. This will have the net effect of exposing crewmembers to greatly extended periods of steady and impulse noise in a 24-hour day. It will also likely induce fatigue and dehydration in large numbers of troops.

Extended exposure to hazardous levels of steady and impulse noise, especially when combined with other stressors, will present a serious risk of temporary and permanent hearing loss. Both types of hearing loss can degrade combat effectiveness by impairing effective command, control and communications, disrupting critical operator tasks, and degrading critical hearing-intensive combat activities. In addition, permanent hearing loss constitutes grounds for disability compensation.

The effective protection of troops from loss of hearing requires adequate hearing protective devices, both insert types and over-the-ear types. However, not all available hearing protective devices provide adequate protection. Rigorous evaluation of developmental equipment, including helmets with ear-cups, communication headsets, and commercially available protective devices, is required to insure adequate protection. Further, an effective hearing conservation program requires up-to-date epidemiologic data on the



extent of hearing loss and the resulting impact among specific groups of Army personnel.

The primary goal of this research program is to assess the effectiveness of hearing protective devices in order to minimize the incidence and severity of noise-induced hearing loss among Army personnel. Long-term goals include (1) the development of improved technologies and approaches for hearing protection and (2) the development of improved methodology for evaluation of hearing protective devices.

**Objective** The major technical objectives of this research program include measurement of the sound-attenuating characteristics of passive and active hearing protective devices and communication headsets, determination of the suitability of selected devices for specific Army applications, assessment of the influence of user variables on protective effectiveness, development and evaluation of new concepts for improved hearing protection, development and validation of improved laboratory and field techniques (e.g., physical ear method) for evaluation of hearing protective devices, development and validation of mathematical models for predicting suitability of hearing protective devices, assessment of attenuation characteristics on audiologic performance, and epidemiologic assessment of the extent of hearing loss and the associated impact among selected groups of Army personnel.

**Progress** Attenuation characteristics of DH-178 helmets for potential use in field validation studies were measured. This testing was conducted in preparation for direct validation studies with the VIPLR shoulder-fired anti-tank rocket and the M198 towed howitzer.

Two different standards, the ANSI 24.22 and ANSI 3.19, were used to measure attenuation of SPH-4 and DH-132 helmets. Only small differences were found between the two measurement procedures. The results were used to determine if changes in the helmet specifications were required.

Real-ear attenuation characteristics of various hearing protective devices were measured as part of a study conducted in collaboration with the Environmental Protection Agency. The results will contribute to the characterization of data variability resulting from variations in procedures used at different laboratories.

The effects of a female's long hair and smaller head size on attenuation characteristics of the SPH-4 aviator helmet were studied. Data analysis is in progress.

As part of an effort to develop a quality assurance method for procurement activities, attenuation characteristics obtained with a physical measurement method were compared with measurements obtained using the ANSI 3.19 standard (i.e., a real-ear method). If successfully validated, the physical method would decrease testing time

and provide additional information for frequencies not measured with the real-ear method. Analysis of data is in progress.

A study was conducted to evaluate the effects of training in proper fitting procedures on attenuation characteristics of the triple-flange earplug. It was shown that training effects can be sizable.

**PUBLICATIONS:**

*The Effect of the Louvered Scarfed Shroud Suppressor (LSSS) On Sound Pressure Levels in and Around OV-10, USAARL LR 81-3-2-2.*

*Noise Levels Measured in the T-Tail YAH-64, USAARL LR 81-4-2-3.*

*Real-ear Sound Attenuation Measurements of a DH-132 Helmet in Combination with E-A-R Earplugs, USAARL LR 81-6-2-5.*

*The Effects of Graphite/Aluminum Composite Doubler Plates on the Acoustic Output of a CH-47 Helicopter Forward Rotor Transmission During Flight, USAARL LR 81-9-2-8.*

*Evaluation of Two Parachutists Helmets, USAARL 81-10-2-9.*

**PRESENTATIONS:**

*Sound Attenuation Provided by Helmets in the U.S. Army, presented to Aerospace Medical Association, May 81.*

**DD 1498**

The above work has been conducted under Research and Technology Work Unit Summary.

Medical Assessment of Hearing Protective Devices, DAOB 6888, 135.

**Contributing Work**

Work done under the following contract contributed to this research program.

Crushable Earcup Development

# Impact Biodynamics of Crashworthiness & Personnel Armor Program

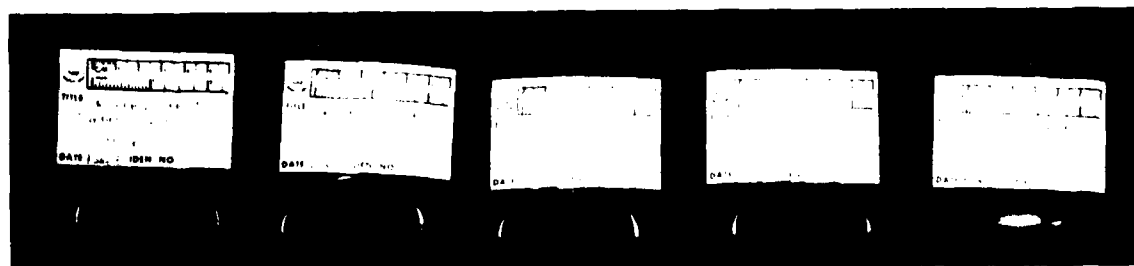
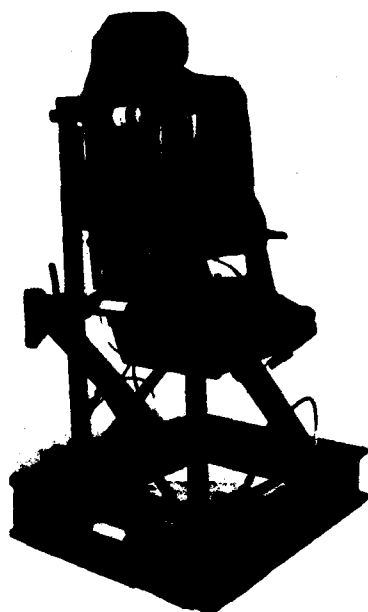
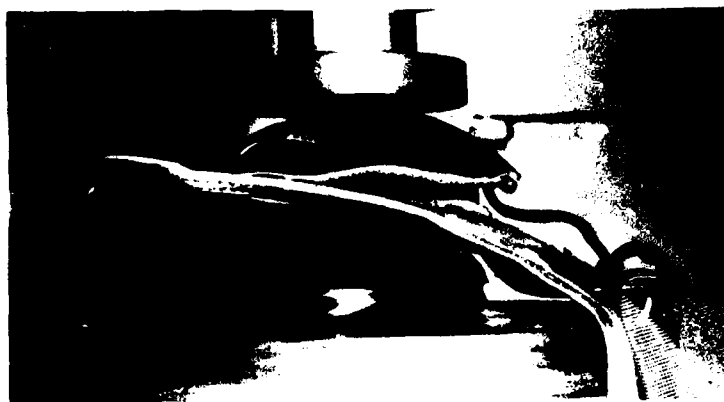
**Background** This program addresses (a) the ever-present hazard of violent impact between the interior of a moving vehicle and the soldier operator or passenger as a result of crash or accident, and (b) the battle-related hazard associated with body armor impact after defeat of large caliber (50 cal plus) ammunition, i.e., the rear surface "signature" of deforming body armor. Historically, man has been restrained in aircraft by a lap belt to simply prevent falling from the craft during roll overs in flight. In more recent years, the restraint provided has increased from a level of 5g to 40g to provide protection in accidents. Man's ability to remain conscious during a 40g vehicular impact is limited, however, by the individual's age, the type of harness employed, and the direction-of-force and rate-of-onset associated with an impact.

In the area of body armor, recent technological advances have resulted in the capability to defeat .50 cal and larger projectiles. While it is possible to prevent penetration by such projectiles, there remains considerable information to be known regarding the secondary wound potential associated with such armor as a result of the shock transmitted and the nonpenetrating deformation which occurs. The evaluation of man's tolerance to impact and the effectiveness of protective restraint systems and personnel body armor are required for survival in the modern battlefield.

**Objective** The objectives of this program are to provide a technological data base relating to the biomedical aspects of the evaluation of life support equipment (LSE), and its correlation with injury data collected from the field; to identify hazards associated with LSE; to provide conceptual design recommendations and criteria to improve LSE, including personnel armor; and to provide evaluation of crash-related LSE and its correlation with injury data collected from the field through a tri-service LSE retrieval program (LSERP).

**Progress** Presentations were made to the Joint Committee on Aviation Pathology and the Neuroelectric Society concerning helmet damage/injury correlation. A paper was presented to the Aerospace Medical Association on US Army Life Support Training. Consultations were provided to the US Army Safety Center, the Air Force, and the Navy concerning injury prevention aspects of specific life support





equipment. LSERP reviewed over 50 Preliminary Report Aircraft Mishaps (PRAMS); 10 of these mishaps were made into case studies. The LSE returned from these accidents included 22 helmets (1 USAF and 4 USN), 4 restraint systems, and 5 seats. Evaluation letter reports were submitted to the appropriate personnel for this equipment.

A joint study was conducted with the US Army Safety Center to correlate injury to LSE deficiencies in aircraft design. The Medical Factors for Personnel in Accident form (DA Form 2397-11) was re-written to improve the flow of injury information from the field.

Ten more helmet cases were added to the USAARL data bank and several helmets were selected for future simulation analysis, i.e., the replication of helmet damage sustained in the crash event.

The helmet damage validation with human surrogates by Wayne State University was completed. The data is being analyzed for potential USAARL replication.

Two new studies, a prospective analysis of head and spinal injuries sustained in aviation accidents and the relationship of posture and vibration to backache in helicopter crewmembers, were initiated.

PUBLICATIONS: *Helicopter Crashworthy Fuel Systems and Their Effectiveness in Preventing Thermal Injury* (Reprint), USAARL RPT 81-4.

PRESENTATIONS: *Head Impact Hazards in Helicopter Operations and Their Mitigation Through Improved Helmet Design*, presented to Neuroelectric Society, Dec 80.

*Head Injury in Helicopter Accidents as Related to Head Impact Simulation and Human Tolerance*, presented to Joint Committee on Pathology, Oct 80.

*Impact and Vibration Testing of a Modified UH-1 Crew Seat*, presented to Aerospace Medical Association, May 81.

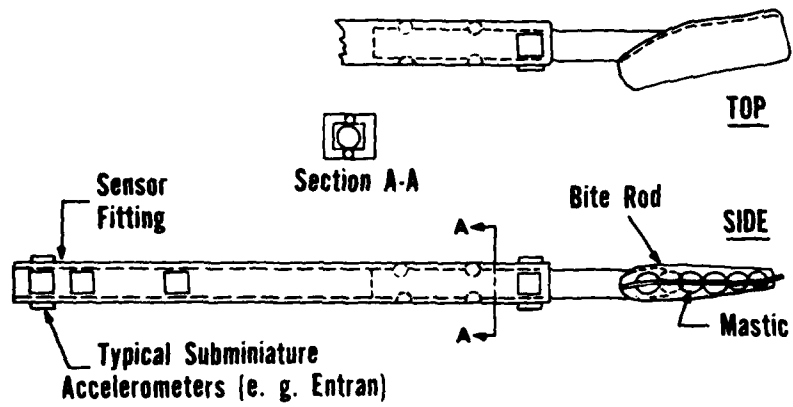
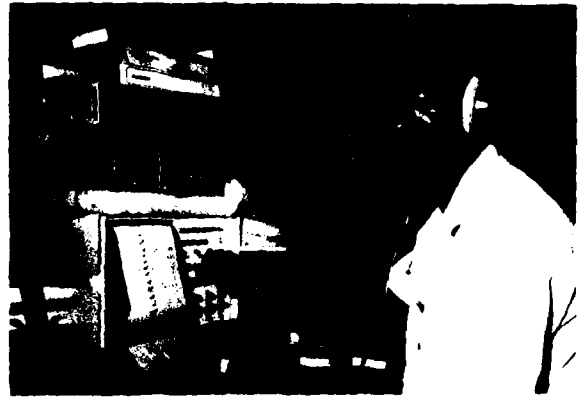
*U.S. Army Aviation Life Support Training*, presented to Aerospace Medical Association, May 81.

**DD 1498** The above work was conducted under Research and Technology Work Unit Summary

Biodynamics of Life Support Equipment and Personnel Armor, DAOG 0167, 151.

**Contributing Work** The following contract work contributed to the research objectives of this program.

Material Characteristics



# Vibration Hazards of Combat Vehicles Program

**Background** The vibration program was initiated in order to prevent vibration related musculoskeletal disorders in Army aviators. The effects of vibration on the visual, auditory, vestibular and neuromuscular function are not fully known inasmuch as unique vibration exposure characteristics are associated with each emerging military vehicle or weapon system. Therefore, the scope of this program has been expanded beyond the aviation community to include the prevention of vibration related disease and the minimization of vibration-related operator control decrements caused by Army materiel.

Immediate goals include the development of strength criteria for aviators in vibration environments, a vibration-related lower back pain assessment, and a dynamic visual acuity assessment under vibration conditions. Concurrent with these goals is the completion of a laboratory on-line data capturing system. The long term goal of the vibration program is to develop human tolerance limits to vibration, as a function of amplitude, frequency, and exposure rate, that can be used as criteria for vehicle development.

**Objective** In order to assess vibration hazards of combat vehicles the objectives established are to measure neck muscle activity changes induced by postural effects and vibration of a supine seat, to measure the effects of whole body vibration in a semi-supine seat on static and dynamic visual acuity with a video display, to measure the effects of vibration in a supine seat on selected measures of cardiopulmonary mechanics, to measure helmet vibrations induced by mechanically coupled sites, and to compare studies on vibration levels in US Army helicopters and offer recommendations for measurement uniformity.

**Progress** Work conducted under reimbursement from the High Survivability Test Vehicle-Lightweight (HSTV-L) program has been completed. The three research projects used human subjects to determine muscle stress, visual acuity decrements, and changes in cardiopulmonary mechanics due to vibration in a semi-supine seat. The neck muscle stress data was reduced and demonstrated that a significant increase in neck muscle stress occurred in the full supine seat position when the volunteer lifted his head to isolate it from head-rest vibration. The measurement of dynamic visual acuity associated with the viewing of an HSTV-L monitor demonstrated that vibration

dramatically reduced acuity and that such reductions were much less for high contrast targets than for low contrast targets. The evaluation of cardiopulmonary mechanics demonstrated that with vibration, cardiac output generally decreases by 10% and minute volume increases. The results of these three projects have been presented at the annual Aerospace Medical Association meeting, the Tri-Service Technical Working Group for Biodynamics, and the International Workshop on Research Methods in Human Motion and Vibration Studies.

The determination of the extent to which aircraft vibration was coupled to a crewman's flight helmet by mechanical linkage of a helmet mounted sight was reported. The comparison of a standard UH-1 seat with a modified German seat was presented at the Aerospace Medical Association annual meeting, May 1981. A comparative summary of vibration levels in Army helicopters and a proposal for measurement standardization was presented at the International Workshop on Research Methods in Human Motion and Vibration Studies. Experimental apparatus for the measurement of dynamic visual acuity, pilot strength measurement, and low back pain assessment have been completed. Final design of the vibration laboratory on-line data capture and reduction system has been completed.

**PUBLICATIONS:** *Vibration in a Helmet Mounted Sight (HMS) Using Mechanical Linkage, USAARL RPT 81-3.*

*Vibration Levels in Army Helicopters--Measurement Recommendations and Data, USAARL RPT 81-5.*

*Operator's Manual for Variable Weight, Variable C.G. Helmet Simulator (Reprint), USAARL RPT 81-7.*

**PRESENTATIONS:** *Neck and Muscle Stress Induced by Postural Effects and Vibration of a Supine Seat, presented to Aerospace Medical Association (Proceedings, p. 209), May 81.*

*The Effects of Random Vibration on Human Subjects in a Semi-Supine Seat, presented to Research Methods in Human Motion and Vibration Studies, Sep 81.*

**DD 1498** The above work was conducted under Research and Technology Work Unit Summary.

Vibration Hazards of Combat Aircraft and Vehicles, PAOG 6100, 132.

**Contributing Work** Work conducted under one customer-funded and two contract projects contributed to the research objectives of this program.

Health Hazard Assessment and Implications of Whole-Body  
Vibration Associated with Advanced Combat Vehicle Tech-  
nology.

Study for Vibration Effect on Muscular Performance.

Effects of U.S. Army Headgear on Neck Muscle Loading and  
Fatigue.



# Crew Life Support Systems Biotechnology Program

**Background** Modern warfare is predicated on the use of an ever increasing variety of technologically advanced weapons, transport and communication systems. Couple this trend with doctrine which emphasizes round-the-clock sustained operations and there exists the potential for a devastating conflict. On the one hand, the advanced technology and new tactics give our troops an edge in any potential battle. On the other hand, man's inherent physiological, and perhaps psychological, limitations can totally neutralize any such advantage. The Crew Life Support Systems Biotechnology Program is designed to identify, evaluate and eliminate or prevent the health hazards resulting from the mismatch between the soldier's physiologic needs and the environment resulting from use of new equipment, weapons and tactics.

Specifically, current focus is on maintaining aviators in the proper state of oxygenation under all flight conditions and on minimizing the deleterious effects of wearing chemical protective ensembles while conducting aviation operations and training. Short range goals are (1) to evaluate the concept of using pressure swing molecular-sieve technology to produce clean breathable oxygen-enriched air to alleviate all levels of hypoxia, and (2) to evaluate current and proposed chemical defense ensembles in the flight environment to ascertain how long aviators can fly effectively without succumbing to heat stress or other stressors imposed by these basically cumbersome protective systems. Long range goals call for collection of extensive data bases relating physiologic response to environmental stressors from which computer models can be developed which will assist in optimizing life support systems design.

**Objective** The Crew Life Support Systems Biotechnology Program is designed to identify, assess and prevent unnecessary health hazards imposed by exposure to the operational environment, toxic gases, varying oxygen levels, chemical and biological agents and antidotes or other drugs; to provide the Army technical information, recommendations and standards to be used in the development and modification of systems that provide protection from those hazards; and to develop a data base identifying and quantifying the physiological and medical impact of life support equipment on mission accomplishment. This program is also designed to identify and elucidate problems associated with life support equipment and to develop computer models



based on analytic and empirical data to facilitate the conceptualization and development of design criteria for improved life support equipment.

**Progress** Data was collected and analyzed on the operation of two on-board Oxygen Generation Systems (OBOGS) in the U-21 fixed wing turbo prop aircraft. Results were presented at the Aerospace Medical Association and are being written up for publication. Preparations are complete to collect data on the same two systems in the UH-1H rotary wing aircraft. A laboratory prototype of an OBOGS unit is being built to assess the ability of this technology to act as a filter to protect the aviator from battlefield contaminants. A protocol has been written to determine the oxygen requirements of helicopter pilots during different flight regimes.

A protocol entitled "Physiological Assessment of the Aircrew Chemical Defense Ensemble" was written approved and implemented. Phases I and II in which aviators flew prescribed maneuvers while wearing current and proposed chemical defense (CD) ensembles were conducted. Physiological, psychomotor and performance data were collected and are being analyzed. Preliminary results will be presented at the Tri-Service Aeromedical Panel Meeting. Preliminary conclusions regarding training in CD ensembles have been shared on an informal basis with members of the NBC Steering Committee at Ft. Rucker, Ala; Bob Matthews, LSE Coordinator, AVRADCOM; Dr. Wes Baumgardner, USAF School of Aerospace Medicine; and Dr. Michael Fisher, Aeromedical Attache, British Embassy.

Team members have been active in many meetings to discuss and plan for design, test and evaluation of the Aviation Life Support Equipment Systems for the Integrated Battlefield (ALSSIB), for evaluation of a USAF-sponsored second generation chemical defense ensemble, and for operational tests of chemical defense ensembles sponsored by TRADOC scheduled for FY82.

As part of the program to assess pulmonary function in the operational environment, a Perkin-Elmer medical gas analyzer was evaluated in the inflight helicopter environment. A final report is in preparation for publication in early FY82.

Computer modeling was begun with the transfer of BRNSIM, a burn simulation model, from the PDP 11/40 at LSU School of Medicine to our in-house PDP 11/03. During FY82, three other models will be made operational: RESPIRO, an automated analysis of the forced expiratory spiogram with English language diagnosis; MACPUF, a respiratory system simulation mode; and Heat, a heat stress model.

PRESENTATIONS: U.S. Army Aviation Oxygen System, presented to SAFE, Oct 80.

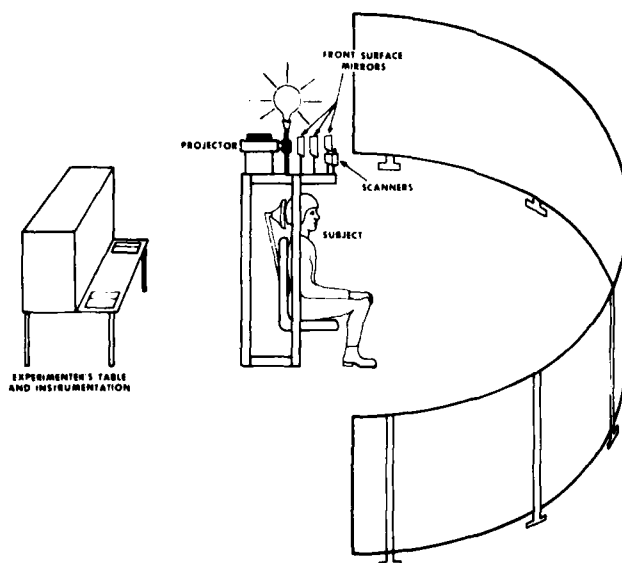
Evaluation of Onboard Oxygen Systems for U.S. Army Aircraft, presented to Aerospace Medical Association, (Proceedings, p. 195), May 81.

*Chemical Defense, Flight Surgeons Course, Mar  
& Sep 81; Operation Problems Course, Apr 81.*

**DD 1498** The above work was conducted under Research and Technology Work Unit Summaries.

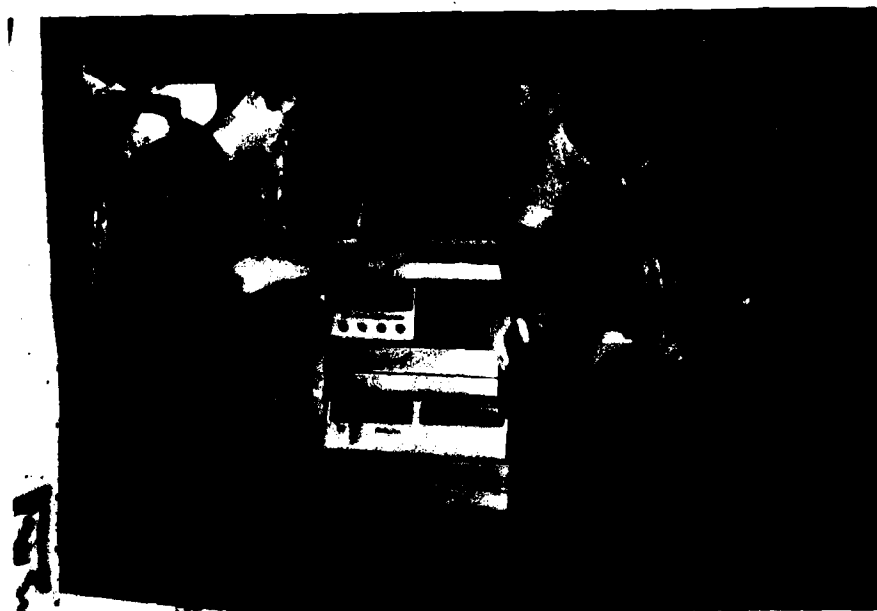
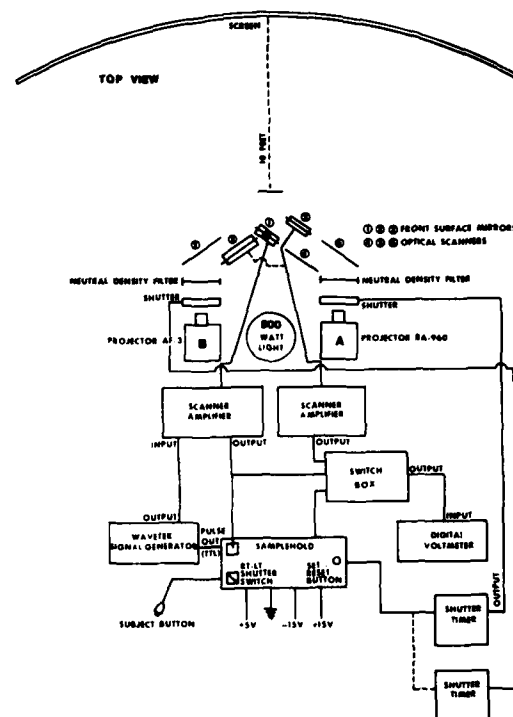
Biomedical Applications and Health Hazard Assessment of  
Oxygen Enrichment Breathing System, DAOG 0169, 168.

Research Countermeasures for Significant Medical Hazards in  
Military Systems, DAOG 0165, 167.



## Combat Crew Effectiveness Research Area

This project area is principally oriented toward the behavioral, psychologic, and performance requirements imposed by military operations. It aims to prevent casualties by focusing on (a) predisposing factors which make the individual soldier more vulnerable or susceptible because of inadequate physical conditioning, training, indoctrination, and instigation of coping skills, and (b) extremely high stress loads imposed by harsh environmental extremes, complex and exhausting performance demands, and life threatening risks which may exceed human tolerance. Physiological and psychological investigations are pursued to identify environmental and operational stressors and to develop analogues to dose-response relationships between such stressors and soldier tolerance and survivability. Efforts of military relevance include but are not limited to medical indices of crew workload and fatigue, physical fitness and personnel selection criteria, environmental stresses of heat, cold and altitude, and biomedical aspects of sustained operations.



# Sensory Limitations of Man/Machine Systems Program

**Background** The extreme lethality of the modern mid-to-high-intensity battlefield is forcing changes in tactics, weapons, and personal protective equipment. Advancing weapons technology along with doctrinal requirements for continuous operations (including nighttime operations) for combining to produce stresses which threaten to exceed the capabilities and limitations of human operator and thereby degrade crew performance. For example, the visual demands of night vision goggles may necessitate new visual selection and retention criteria, and the requirement for continuous operations may exceed the soldier's visual performance capabilities after extended periods of operation. The use of protective devices such as anti-laser goggles, the sun, wind and dust goggles, and helmet visors threatens to disrupt crewmembers' visual performance.

The doctrinal requirement for around-the-clock combat operations results in special concerns about the human operator's capabilities to function effectively in darkness. Red lighting has been used in Army aircraft cockpits since pre-World War II days because of its ability to preserve nighttime visual sensitivity. However, in future aircraft blue-green lighting will be required in order to achieve compatibility with aviator night vision goggles. This may compromise flight capabilities with unaided vision. The existing biomedical data base regarding the visual performance effects of vibration, darkness, night vision goggles, protective goggles, and similar stressors is inadequate for countering the potential threats to combat effectiveness. The nature, extent and mechanisms of visual performance degradation are largely undefined, and the resulting impact on combat effectiveness has not been determined.

The overall goal of this research program is the development of realistic measures to prevent compromised combat effectiveness due to impaired visual performance. These preventive measures will include exposure criteria, material design criteria, crew selection and retention criteria, and modified operational doctrine. A major intermediate goal is the establishment of a visual effects biomedical data base sufficient to support development of such measures.

**Objective** The major technical objectives of this research program include identification of the parameters of visual functioning which are degraded by vibration, darkness, body position, protective devices, night vision goggles, fatigue, and spectral characteristics

of lighting. Characterization and quantification of visual degradations produced by specific stress factors, identification and characterization of mechanisms underlying visual degradations, determination of the relationships between identified visual degradations and task performance, and development and validation of models for predicting the impact of specific visual degradations on combat effectiveness are major technical objectives. Also, included as objectives are development and validation of exposure criteria and/or material design criteria for selected stress factors, development and validation of selection/retention criteria and operational preventive measures for selected stress factors, and development of instrumentation for rapid, reliable measurement of selected visual performance parameters.

**Progress** In studies of dark adaptation it was found that (1) under conditions of nearly total darkness red lighting preserves dark adaptation from 10 to 30 times better than blue-white light, (2) under simulated full moon illumination there is no difference between red and blue-white illumination with respect to their effect upon dark adaptation, and (3) there was a large amount of spreading of adaptational effects to the non-stimulated area of the retina which cannot be explained solely by stray light. A report of this work is in preparation. Also, it was found that individuals with abnormal color vision do not exhibit better nighttime vision than those with normal color vision. A report of this work is in preparation.

In the area of personal protective equipment and optical devices it was found that a new visor manufactured by a prospective vendor had a potentially deleterious effect upon the aviator's vision. A report of this work is in preparation.

The visual properties of the sun, wind, and dust goggles were evaluated in order to determine whether this device is suitable in a desert environment for aviation use instead of the helmet visor. It was found to be suitable and a report is in preparation.

In a study of daytime peripheral detection, it was found that visual field size is highly correlated with previously determined mean detection times and that dark aircraft are more easily detected in the sky than lightcolored aircraft. This work was presented at the 1981 meeting of the Aerospace Medical Association. Proposed criteria for operational laser screening examinations were also presented at this same meeting. In support of the night vision goggles, a survey of 850 medical records of Fort Rucker aviators was conducted in order to determine what percentage of aviators have an astigmatism of one diopter or greater since astigmatism, unlike spherical aberrations, is not corrected by the NVG's. Furthermore, it had been found in previous work that aviators with an astigmatism of one diopter or less are generally able to achieve an acuity of 20/50 through the NVG's whereas those having an astigmatism of greater than one diopter

could generally achieve only 20/60 acuity or less. Of the aviator population of Fort Rucker, 3.64% have an astigmatism of one diopter or greater. A report of this work is in preparation.

**PUBLICATIONS:**

*A Reflection Analysis of Alternative Canopy Curvatures for the Advanced Attack Helicopter, USAARL LR 81-8-2-7.*

*Feasibility of Utilizing a Photochromic Combiner in the Integrated Helmet Display Sighting System, USAARL LR 81-7-2-6.*

*Computer Model for the Evaluation of Symbology Contrast in the Integrated Helmet and Display Sighting System, USSARL RPT 81-7.*

**PRESENTATIONS:**

*Potential Initial Aviator Vision Standardization Among ASCC Member Nations; A Discussion Paper, presented to the Air Standardization Coordinating Committee, Nov 80.*

*Operational Laser Screening Examinations, presented to Aerospace Medical Association (Proceedings, p. 96), May 81.*

*A Comparison of Visual Fields with Fixed and Moving Fixation Points, presented to the Aerospace Medical Association, May 81.*

*Physiological Effects of Red Versus Blue-Green Lighting, presented to BG Parker, Aug 81.*

**DD 1498** This work was conducted under Research and Technology Work Unit Summary.

Military Visual Problems: Assessment, Mechanisms, and Protection, DAOB 6893, 164.

Assessment of Visual Performance Based Upon New Knowledge of Retinal Function, DAOG 1490, 278.

**Contributing Work** Work conducted under one customer-funded and one contract project contributed to the research objectives of this program.

Development of Measurement Techniques for the Medical Assessment of Visually Coupled Systems (VCS) Components

Effects of Visibility





# Biomedical Aspects of Crew Workload, Selection & Staffing Program

**Background** Identifying, defining, and quantifying man's physical requirements, task demands, and biomedical limitations associated with various systems and technology become critical for the optimal design of equipment, prediction of performance criteria, and development of biomedical models. Military developers, planners, and specialists at every level must be aware of the unique hazards generated by Army systems and technology, and that these hazards are further elevated by the adverse environment of the Army tactical operations in which the soldier is required to function.

Army aviation, with its highly sophisticated airborne systems, represents a prime example of a military operational area that lacks complete parametric research to develop empirical anthropometric criteria for ideal man-machine interface, and analytical tolerance/survivability/capability envelopes within which the selected aircrew will be forced to work and endure.

For example, the anthropometric criteria for flying duty which have been employed in the past have been predicated solely upon data from Army males, with no information for female selection criteria. Furthermore, there have been no formal studies of current Army aircraft to empirically evaluate the anthropometric regiments to assure a proper aviator-cockpit fit. Finally, a more complete biometric data base is not available to describe and quantify pilots' physiological and psychological tolerance to operational stressors, military hardware, advanced tactics, and progressive military operations.

USAARI's research program is designed to establish/update aircrew selection criteria, evaluate empirical anthropometric requirements for optimum man-machine interface, and provide physiological and psychological guidelines describing and quantifying tolerance survivability and capability envelopes of man within the military flight environment. The long range goals of this research are to establish extensive biomedical data bases and predictive models to reduce or eliminate aviators' impaired performance sensory, cognitive, and physical overload combat stresses and, in general, reduction of hazards inherent in Army systems and in the Army environment.

**Objective** One objective of this research program is to develop standards for aeromedical hazard definition and to postulate hazard definitions based upon field assessment of combat operations, including systems and environmental effects, another objective is establishment of a multi-phase study to recommend static determined work-related minimum and maximum anthropometric criteria, to examine the need for separate seated eye-height criteria, to evaluate the need for minimum strength criteria, and to recommend minimum and maximum weight requirements.

Extension of the data base regarding the visual performance/workload of fixed and rotary wing aviators during varying tactical missions with special emphasis on the quantification and interpretation of these data, on their relation to variables such as pilot physiological and psychological states, and on task loading comprises an objective of this program. Further objectives include determining decision requirements/processing limitations of man and developing predictive models identifying cognitive capabilities and overload criteria incurred by highly sophisticated aircraft technology within a combat environment, defining and quantifying aviator psychomotor performance and tolerance/survivability/capability envelopes; and correlating the results of the above visual, mental and psychomotor processes with the biomedical parameters affecting aviation personnel during sustained military operations.

**Progress** A request was received from the Commander, U. S. Army Health Services Command, asking the laboratory to assist in attempting to identify unique health hazards, workload problems, and morale issues of select aviation medical evacuation units within the command. Four units were evaluated by a USAARL team which acquired interviews, questionnaires, and task component/summation data. The results are currently being reviewed and analyzed. A report will be forthcoming.

Due to the lack of funding throughout the first 11 months of FY81, progress in the multi-phased anthropometric study has been limited to the performance of a pilot study to evaluate fatigue and cardiovascular response to large numbers of repeated isometric exertions and to the in-house fabrication of major pieces of equipment required to assess dynamic strength capabilities.

The visual data base has been expanded to include a comparison of helicopter copilot workload while using three navigation systems during nap-of-the earth flight. Additional data have been collected comparing the visual workload of pilots during scout helicopter operations in the OH-6 and OH-58 helicopters.

Presentations of the program's status and results have been provided at the American Helicopter Society Annual Meeting, the Aerospace Medical Association Annual Scientific Meeting, and the 7th Medical Command Aviation and Medical Conference. Additionally, briefings were provided for US National Guard units, project managers of both the Advanced Attack Helicopter and the Near Term Scout Helicopter,

other DOD agencies, and industry. During the past year, one technical report and four articles were published.

PUBLICATIONS: *Aeromedical Factors in Aviation Fatigue, Crew Work/Rest Schedules and Extended Flight Operations: An annotated Bibliography*, USAARL RPT 81-1.

*The Real Thing*, Army Aviation Digest, Oct 80.

*Down In Dirty*, Army Aviation Digest, Nov 80.

*25th Century Today*, Army Aviation Digest, Mar 81.

*Aviation Night Vision Goggles with Sub-miniature Instrument Display*, R, D & A, May/June 81.

PRESENTATIONS: *Crew Rest and Workload*, presented to 7th Medical Command Aviation & Medical Conference, Nov 80.

*Aviation Operations/Crew Rest and Fatigue*, presented to Maine Air National Guard, Feb 81.

*Rotary Pursuit Tracking Task Performance in Conjunction with Extended Flight in a Simulator*, presented to Aerospace Medical Association, Mar 81.

*Comparison of Helicopter Workload While Using Three Navigation Systems During Nap-of-the-Earth Flight*, presented to American Helicopter Society, May 81, (Preprint 81-16).

**DD 1498:** Work under this program was performed under five 1498's.

Anthropometric Criteria for Army Aviators, DAOG 6102, 166.

Parametric, Multimodel Workload Assessment in Aircraft Guidance Systems, DAOG 6101, 163.

Visual Performance Research Related to Operational Problems in Army Aviation, DAOG 0156, 162.

Aeromedical Research of Operationally Significant Problems in the Army Aviation Environment, DAOG 0151, 165.

Research Directed at Biomedical Parameters Affecting Aircrew Workload During Sustained Operations, DAOG 0153, 161.

Cardiopulmonary Physiology in Army Aviators, DAOG 1505, 279.

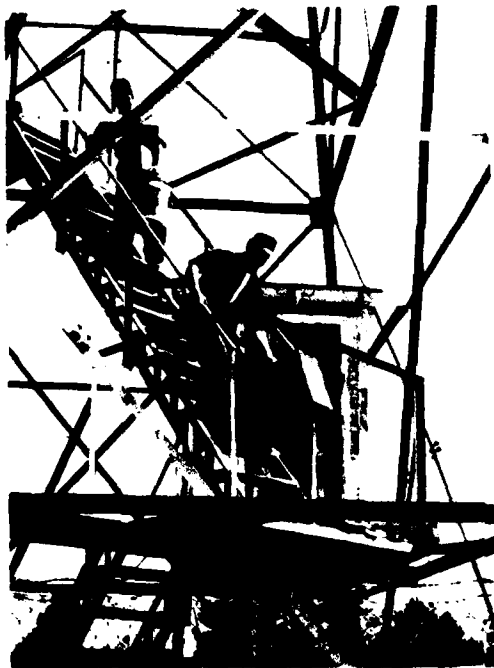
**Contributing Work** Work conducted under three customer-funded and one contract project contributed to the research objectives of this program.

Aviator Workload/Performance Assessment in Support of Advanced Attack Helicopter

U.S. Coast Guard Scan Behavior During Search and Rescue Operations

Night Vision Goggles Attitude Display Concept Evaluation Program

Statistical Analysis of Visual Performance of Helicopter Pilots During Instrument Flight on Repeated Flight



## **Soldier Chemical Warfare Agent Antidote Research Area**

The overall objective of this program element is establishment of the technology base required to develop safe and efficacious prophylaxis, pretreatment compounds, antidotes, therapeutics, patient decontamination, and medical management necessary to assure individual protection, rapid return to duty, and militarily effective soldier performance on a CW battlefield. This will require development of (a) medical concepts and technologies, (b) pharmacologic, medical, and resuscitative materiel, and (c) resources and systems for prevention, decontamination, handling, treatment, evacuation, and management of CW agent casualties. Emphasis is placed on development of antidotes that will assure soldier protection against the primary threat CW agents.

# Antidote & Antidote/Agent Effects on the Visual System Program

**Background** The chemical warfare (CW) capabilities of the Warsaw Pact pose a real threat for potential mass casualties that could at the very least compromise unit effectiveness. Serious deficiencies in the existing protective capabilities include the lack of CW agent prophylaxes, an incomplete spectrum of antidotes, and antidotes with operationally compromising side-effects. The urgent DOD requirement to develop prophylaxes, pretreatment compounds and antidotes, and the necessary concepts for their use in the medical management of CW casualties cannot be accomplished through the utilization of currently available information and technology. We do not know the mechanisms of action for the current CW agents or their suspected antidotes or possible prophylactic compounds. And there is even less information regarding the combination of the three.

CW agents, especially the nerve agents (organophosphates), have diverse toxic effects on both the central and peripheral nervous systems. Many of the central and peripheral toxicities consist of disruptions of neural functions related to the action of organophosphates on neural transmission in the cholinergic system, where acetylcholine is the known neurotransmitter. We know that acetylcholine is important in control of pupil size as well as the processing of visual information by the retina. It may also be important at more central visual locations. However, neurotransmitters other than acetylcholine may also be involved and contribute to organophosphate induced neurotoxicity.

In any battlefield situation, the soldiers' capability to perform visual tasks is critical for completion of the mission. With widespread use of CW agents, the survival of the unit as well as the individual may depend on visual capabilities. Consequently, the Army's effort to develop antidotes, pretreatments, and prophylactics require valid information on the effects of these compounds on visual functions. The primary objective of this research program is to develop a comprehensive biomedical data base on the effects of selected nerve agents, candidate antidotes, possible prophylactic compounds, or combinations of the three on the retina and higher visual centers. Animal models will be selected or developed to enable inferences regarding effects on the human visual system of various

agent/antidote/prophylactic compound combinations. Ultimately, methods will be developed to predict how well a soldier will be able to visually complete his mission following a specified exposure.

**Objective** The following technical objectives are required to achieve the program's goals:

(1) Characterization of the effects of nerve agents and/or their antidotes or pretreatments on retinal functions by means of acute and chronic animal experiments utilizing neurophysiological techniques. The retinal functions to be evaluated include: light/dark adaptation, relative sensitivities across classes of retinal neurons, spatial-temporal contrast sensitivities, stimulus-response relationships, receptive field properties, and spontaneous activity.

(2) Quantification of transmission loss along the visual pathway with gross potential neurophysiological recording techniques, and assessment of performance loss due to drug exposure.

(3) Assessment of cholinergic system interactions with other transmitters in the visual system following drug administration.

(4) Identification of sites of action and uptake of antidotes and agents within the visual system by means of autoradiography to provide additional information as to the mechanisms of action and the possible occurrence of local pooling of nerve agent.

(5) Comparison of single cell data with gross potential and anatomical findings to provide an overall picture of visual systems function following antidote/agent insult.

(6) Development of models and techniques to predict impact on human visual performance and combat effectiveness.

**Progress** Since this is a new program that was only recently begun, there is no technical progress to report. Experiments have been planned and protocols are in preparation. The majority of the necessary equipment has been placed on order.

**DD 1498** Antidote and Antidote/Agent Effects on the Visual System, DAOC 8599, 381.

Effects of Nerve-Agent Antidotes on the Visual System, DAOC 1500, 277.





# **Technical Participation**

## **Information and Technology Exchange**

Participation with the other military services and with international groups in projects of mutual interest benefits us scientifically and economically. There is no problem with which we are involved that does not mesh somehow with that of another group.

Working with interservice and international groups provides for the effective interchange and availability of scientific and technical information needed to support the management and execution of our research program. Membership in and association with these groups further USAARL's technology exchange.

This listing does not include USAARL's long-standing participation in technical, professional, academic, and industrial groups which are described elsewhere in this report.

## **Air Standardization Coordination Committee (ASCC) Working Party 61**

The Air Standardization Coordinating Committee (ASCC) Working Party 61 is a chartered international military organization of the English-speaking nations which addresses aerospace medicine and life support. Emphasis is placed on standardization, interoperability, and technology exchange. Member nations include the United States, Canada, United Kingdom, Australia, and New Zealand. USAARL provides technical consultants and a principal committee representative to actively participate in the committee's activities and coordinate Army Medical Department (AMEDD) participation. Major Bruce Leibrecht represents the Laboratory and Army Aviation Medicine to this group.

## International Test Participation Agreements

The ASCC is chartered to negotiate test participation agreements between member nations and military services. These agreements provide for the evaluation, use, test, or review of a specific piece of equipment by another country or service not normally having access to that equipment. The evaluation data may be jointly gathered but, in any event, is shared between countries and published as a formal report in accordance with the terms of the agreement.

### UNITED KINGDOM NBC PROTECTIVE CLOTHING ENSEMBLE

In 1977, USAARL entered into a test participation agreement with the Institute of Aviation Medicine, Farnborough, England, to conduct a physiologic assessment of the United Kingdom Aircrew NBC Protective Clothing Ensemble. This study includes field trials and laboratory tests of the visual and acoustic properties of the AR5 respirator as well as in-flight biomedical assessment of the entire ensemble's effect on pilot performance and pilot thermal physiology. Aspects of this in-depth study are being conducted in conjunction with the Ergonomics Laboratory at the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA, and the Crew Biotechnology Branch of the USAF School of Aerospace Medicine, Brooks AFB, TX.

### NOMEX FLIGHT JACKETS

A second test participation agreement was entered into by USAARI and the Flight Medical Department, Army Aviation, Commonwealth of New Zealand, in 1981. At the 21st meeting of the ASCC WP 61, the Royal New Zealand Air Force (RNZAF) representative requested from the US Army representative that a test participation agreement be established for the purpose of receiving two aviator Nomex flight jackets. The RNZAF desires to test these jackets for comparison purposes with other similar garments. In accordance with this request, the US Army representative procured and provided these jackets in August 1981. This action was accomplished in coordination with the US Air Force.

## **AGARD--Aerospace Medical Panel**

This panel was established in May 1952 and was an early pioneer in AGARD to discharge the mission of bringing together leading personalities of the NATO nations in the fields of science and technology relating to aerospace. The AMP is now one of nine panels. It is concerned with the exchange of information on aerospace medical research and development, the operationally oriented requirements of clinical aerospace medicine, the provision of advice in human engineering problems, and the stimulation of new research activities to assist and enhance pilot performance in the demanding aviation environment. The panel has formally chartered subcommittees in the areas of behavioral sciences, biodynamics, special clinical and physiological problems in military aviation, and the special senses.

USAARL has been an active participant with this panel since 1963. Members of the laboratory serve on AMP subcommittees as technical consultants. COL Stanley C. Knapp is under appointment by the National Board of Delegates to AGARD/NATO as the US Army Representative for this panel. He is also the US cochairman for the Biodynamics Subcommittee.

## **38th Panel Specialists' Meeting, "Aural Communications in Aviation," Soesterberg Airbase, Netherlands**

The importance of aural information in aerospace operations is secondary only to visual information; yet, despite the dependence of military operations on reliable voice communication and the effective use of audio warnings, many of the systems currently employed have serious shortcomings and do not reflect the considerable research effort that has been expended in this area. In modern military aircraft, it is mandatory that aircrews should be able to perceive and respond to audio information, whether this be speech or tones, with minimum effort and highest reliability. However, the low quality of most airborne voice communication systems imposes a high additional workload such that, on occasion, messages have been missed or misinterpreted which, in turn, has led to aircraft accidents.

This symposium covered physical characteristics of speech, ideal systems design for transmission and reception of speech, speech intelligibility tests, the cost of inefficient communication systems in terms of damage to hearing and reduction of operational effectiveness, the evaluation of standard military electronic speech communication systems, audio warnings, hearing standards, and hearing conservation.

USAARL played a developmental role in this symposium, and Mr. Robert T. Camp, Jr., was a co-organizer.

## **NATO DRG Panel, Research Group 6, Effects of Impulse Noise**

Formed in 1978, Canada, France, Germany, Netherlands, Norway, United Kingdom, and the United States collect and evaluate data on permanent threshold shifts induced by shooting noise in military practice from both light and heavy firearms in relation to the noise exposure. The group evaluates methods of measurement of impulse noise and compares the different impulse noise damage risk criteria used by the participating nations. It evaluates the effects of noise induced hearing loss on performance, collects and evaluates data on nonauditory effects, and exchanges information on the applicability of hearing protectors on the effects of hearing protection in military practice.

Dr. Jim Patterson was appointed to membership in this working group in 1980.

## **NAS, NRC, Committees on Vision and Hearing, Bioacoustics, and Biomechanics**

USAARL has been an active participant in the science technology exchange programs of the National Research Council (NRC) since the mid- to late 60's. USAARL scientists participate as working members of the various ad hoc study groups of the acoustics and vision committees. The Army representative to the Committee on Hearing, Bioacoustics, and Biomechanics (CHABA) is a USAARL scientist, MAJ Bruce Leibrecht. Dr. Jim Patterson, LTC Roger Wiley, LTC John Crosley (Ret), and Mr. Robert T. Camp participate actively.

## **Tri-Service Aeromedical Research Panel (TARP)**

The Tri-Service Aeromedical Research Panel (TARP), established in 1976 for the purpose of fostering technical exchange, reviewing ongoing joint research programs, making recommendations for future joint research programs, cooperative review of individual programs to avoid duplication, and submitting a recommended course of action to The Surgeons General, has proven to be an effective administrative entity in the DOD research community. The TARP consists of 12 members which include two laboratory representatives from each service; a Surgeon General representative from each service; one representative of the respective Medical Research and Development Commands from each service; and one representative of the Headquarters, Air Force Aerospace Medical Division, or Headquarters, Air Force Systems Command. The TARP has the authority to charter technical working groups (TWG)

for the purpose of interacting at the scientific bench level and working on viable interservice cooperative research programs. At present, only one TWG exists. It is in the area of biodynamics and the human effects of vibration, impact, and acceleration. Under the auspices of this TWG, a joint service, Department of Transportation study to develop a standardized set of algorithms that biodynamically describe the 50th percentile male has been accomplished with a draft report written in 1980. The TARP meets in business session twice a year and hosts one extensive technical meeting. The TWG meets formally twice a year and other times as necessary. Colonel Knapp is the senior Army member. LTC Roger Wiley represents Laboratory interests.

## **Tri-Service Life Support Equipment Retrieval Program**

USAARL conducts a tri-service life support equipment retrieval program (LSERP) which brings us crash-damaged helmets, seats, and flight clothing for analysis and study. Helmets are the items most often received from the Air Force and Navy.

Army aviation life support equipment involved in either injury causation or prevention, in the field, is sent to USAARL for biomedical and injury correlation evaluation. The evaluation assesses the effectiveness or deficiencies of the life support equipment through an analysis of the physical condition of the protective devices, the human injury incurred, and the related human dynamics involved in the accident.

Data collected through the LSERP helps identify hazard protection problems associated with the equipment. Also, these data enable us to provide injury reducing design recommendations and health criteria for the improvement of life support equipment. The Navy Medical Department maintains a permanent position for a Navy aerospace physiologist at USAARL to support this program. The Air Force has contributed a senior enlisted life support equipment technician to this program.

## **Tri-Service and NASA Human Factors Engineering Technical Advisory Group**

Because of the diversity of subject matter covered by the human factors engineering discipline, the scope of technical areas addressed by the Technical Advisory Group (TAG) is necessarily broad. In general, human factors engineering (HFE), as defined for the purposes of TAG operation, deals with concepts, data, methodologies, and procedures which are relevant to the development, operation, and maintenance of hardware and software systems. Subject matter subsumes all technologies aimed at understanding and defining the capabilities of human operators and maintainers and insuring the integration of the

human component into the total systems to enhance systems effectiveness. Technologies directed toward improved manpower utilization through selection, classification, and training are included as appropriate.

TAG provides a mechanism for exchange of technical information in the development and application of HFE technology. This group enhances the coordination among government agencies and encourages in-depth technical interaction among subgroups in selected topical areas. TAG assists as required in the preparation and coordination of tri-service documents such as technology coordinating papers and topical reviews.

### **Army Aeromedical Concepts Review Committee (AACRC)**

The Army Aeromedical Concepts Review Committee (AACRC) is a standing committee of the AMEDD for the purpose of collecting and disseminating information relative to aeromedical evacuation concepts, equipment, and techniques, and preparing coordinated AMEDD positions on Army aeromedical evacuation issues. The committee meets formally once a year with representation from the worldwide AMEDD aviation community, Army Reserve, National Guard Bureaus, and DA Deputy Chief of Staff for Operations (DCSOPS), and other agencies as appropriate. USAARL, with a mission that includes aeromedical evacuation equipment, development, as well as general aviation medicine support that encompasses AMEDD aviation, has a long-standing history of intimate participation in the committee's activities. MAJ Chester Duncan is the designated laboratory representative.

### **Army Life Support Equipment Steering Council**

This advisory council was chartered in the mid-1970's by the Commanding Generals of the US Army Materiel Research and Development Command (DARCOM), and US Army Training and Doctrine Command (TRADOC), the Office of The Army Surgeon General, and Forces Command. This is a review and advisory technical council that insures timely and pertinent technical exchange of information regarding the development, logistics, use, and field problems associated with Army aviation life support equipment. The committee meets on a twice-a-year basis and has proven to be an effective vehicle for maintaining a coordinated flow of technical information regarding life support equipment and the solution of many technical and administrative life support equipment problems to the Army. USAARL participates as the principal technical consultant to the council and is instrumental in formulating AMEDD positions and policies.

# Committees

Committee	Affiliation	Individual
AEROSPACE MEDICAL ASSOCIATION		
Constitution and Bylaws Committee	Member	COL S. C. Knapp
Scientific Program Committee	Member	Dr. K. A. Kimball
AIR STANDARDIZATION COORDINATING COMMITTEE (INTERNATIONAL)		
Working Party 61 (Aerospace Medicine and Life Support Systems)	Army Representative	COL S. C. Knapp LTC J. K. Crosley
AMERICAN BOARD OF PREVENTIVE MEDICINE (AEROSPACE MEDICINE)		
Professional Examination Committee	Member	COL S. C. Knapp
AMERICAN NATIONAL STANDARDS INSTITUTE		
Z90.1 Helmet Committee	Member	COL S. C. Knapp
Z90.1 Helmet Subcommittee on Helmet Durability	Chairman	COL S. C. Knapp
Z80.1 Ophthalmic Lens Committee	Member	LTC J. K. Crosley
53-62 Working Group on the Effects of Impulse Noise on Man	Member	Dr. J. H. Patterson
Working Group on Real-Ear Attenuation Standards	Member	Dr. J. H. Patterson
DEPARTMENT OF DEFENSE		
Aircrew Station Standardization Panel (Tri-Service)	Member Member	LTC J. K. Crosley MAJ F. F. Holly



Committee	Affiliation	Individual
Joint Service Display Panel Subpanel on Display Devices	Member	Mr. C. E. Rash
Military Librarian's Workshop Program Committee	Member	Ms. S. H. Bullock
Group on Specification Problems and Standardization Actions on Audio Devices	Member	Mr. R. T. Camp, Jr.
Helicopter Research Coordinating Panel (Tri-Service)	Chairman Member	Dr. K. A. Kimball COL S. C. Knapp
Human Factors Engineering Technical Advisory Group (Tri-Service)	Member	Dr. K. A. Kimball
Tri-Service Aeromedical Research Panel (TARP)	Chairman Member	COL S. C. Knapp LTC R. W. Wiley LTC J. K. Crosley
Tri-Service Aerospace Medical Coordina- tion Technical Working Group	Member	Mr. J. L. Haley, Jr.
DEPARTMENT OF THE ARMY		
Advanced Attack Helicopter Alternate System Safety Group	Member	MAJ C. E. Duncan
Advanced Attack Helicopter Source Selection Evaluation Board	Member Member	Mr. C. E. Rash Mr. B. T. Mozo
Aircraft Noise, Working Group (MI'-STD-8806)	Member	Mr. R. T. Camp, Jr.
Army Aviation Personnel Requirements for Sustained Operations, Study Advisory Group	Member	Dr. K. A. Kimball
Biomedical Engineering	Consultant to The Surgeon General	COL S. C. Knapp
Helicopter Medical Human Factors Engineering and Training/Selection Research Coordination Panel	Chairman	Dr. K. A. Kimball
US Army Lighting Advisory Committee	Member	MAJ F. F. Holly
USAMRDC Laser Bioeffects Committee	Member	LTC R. W. Wiley LTC R. K. Crosley

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Committee	Affiliation	Individual
USMARC Neuroscience Working Group for Chemical Defense	Member	Dr. A. W. Kirby
	Member	CPT T. H. Hardy
FEDERAL AVIATION ADMINISTRATION		
Seat Committee	Member	COL S. C. Knapp
NATIONAL ACADEMY OF SCIENCES-- National Research Council		
Committee on Vision	Army Representative	MAJ B. C. Leibrecht
Committee on Vision	Member	LTC R. W. Wiley
	Member	LTC J. K. Crosley
	Member	Dr. I. Behar
Committee on Hearing & Bioacoustics	Member	Dr. J. H. Patterson
	Member	Mr. R. T. Camp, Jr.
NORTH ATLANTIC TREATY ORGANIZATION-- Advisory Group for Aerospace R&D		
Aerospace Medical Panel	U.S. Army Representative	COL S. C. Knapp
Biodynamics Subcommittee	Cochairman	COL S. C. Knapp
Behavioral Sciences Committee, AMP	Member	Dr. K. A. Kimball
Evaluation of Methods to Assess Workload, AMP Working Group 08	Member	Dr. K. A. Kimball
Research Study Group 6, Effects of Impulse Noise	Member	Dr. J. H. Patterson, Jr.
U. S. ARMY AVIATION CENTER		
NBC Steering Committee	Member	Dr. F. S. Knox, III
Army Aviation Threat Committee	Member	Dr. K. A. Kimball
Army Aviation Mission Area Analysis	Member	Dr. K. A. Kimball

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- Patterson, James H. 1981. *Preliminary results of direct determination of the adequacy of hearing protection for use with the VIPER anti-tank weapon*. Presented to NATO DRG Panel, Research Study Group 6, Effects of Impulse Noise, 1981 May; St. Louis, France.
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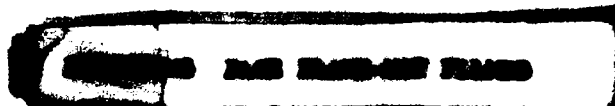
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# **Appendix**

## **Research and Technology Work Unit Summaries (DD 1498) for FY81**



RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION#	2. DATE OF SUMMARY	REPORT CONTROL ST DD-DR&E(AR)JG	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY ACTY	6. WORK SECURITY	7. REGRADING	8. DESIG INSTR	9. SPECIFIC DATA CONTRACTOR ACCESS	10. LEVEL OF A. WORK U. 1
80 10 01	R. CORRECTION	U	U		NL	<input type="checkbox"/> YES <input type="checkbox"/> NO	
11. NO./CODES	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
61102A		3M1611028S10		CB		283	
12. CONTINUING							
STOG 80 7.2.4							
13. TITLE (Protect with Security Classification Code)							
(U) Physiology and Psychophysics of Information Transfer in the Visual System							
14. SCIENTIFIC AND TECHNOLOGICAL AREA							
012900 Physiology; 012000 Optics; 002400 Bioengineering							
15. START DATE		16. ESTIMATED COMPLETION DATE		17. FUNDING AGENCY		18. PERFORMANCE METHOD	
80 10		CONT		DA		C. IN-HOUSE	
19. CONTRACT/GRANT				20. RESOURCES ESTIMATE		21. PROFESSIONAL MAN YRS	
22. DATES/EFFECTIVE:				23. PRECEDENCE		24. FUNDS (in thousands)	
25. NUMBER:				26. FISCAL YEAR		27. CONVEY	
28. TYPE:				81		2.8	
29. KIND OF AWARD:				82		5.6	
30. RESPONSIBLE DOD ORGANIZATION				31. PERFORMING ORGANIZATION		32. POC: DA	
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab			
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Sensory Research Division			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Funding from H. S. Andrews provided)			
NAME: KNAPP, S. C.				NAME: Harding, T. H.			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-5114			
33. GENERAL USE				34. SOCIAL SECURITY ACCOUNT NUMBER:			
Foreign Intelligence Considered				35. ASSOCIATE INVESTIGATORS			
				NAME: Holly, F. F.			
				NAME: McLean, W. E.			
36. REVISIONS (Protect with Security Classification Code)							
(U) Retinal Physiology; (U) Visual Psychophysics; (U) Human							
(U) Visual Performance; (U) Visual Adaptation; (U) Visual Neuropharmacology; (U) Animals							
37. TECHNICAL OBJECTIVE, 38. APPROACH, 39. PROGRESS (Protect with Security Classification Code)							
<p>23. (U) The objective is to provide quantitative information on the physiological processes and mechanisms which underlie visual perception so as to provide a data base which supports applied vision research. By exploring retinal and cortical processes which are involved in the transfer of visual information, a quantitative link may be established between neural mechanisms and visual performance.</p> <p>24. (U) The approach primarily includes single and multiple neuron recording techniques in animals and evoked potential and psychophysical procedures in human subjects. Results from animals will be used to construct models of the human visual system. A multidisciplinary approach will include (1) neurophysiology, neuropharmacology and neuroanatomy, (2) optical physics, optometry and physiological optics, and (3) sensory psychology.</p> <p>25. (U) 8010-8109. A project concerned with perceptual oscillations to single pulses of light was completed. A light emitting diode visual stimulator has been built which provides temporal modulation of spectrally broad light flashes where intensity is proportional to voltage over a range of 10,000 to 1. A computer interface for producing well controlled pattern stimuli on a CRT has been developed. Additional progress includes completion of a heart rate monitor, an extracellular action potential interface to a computer and a hydraulic microdrive system for positioning microelectrodes on the intact retina. Reports in preparation for open literature include "Oscillations in the Visual Response to Pulsed Stimuli," "Spatial Relationship Between a Cat Retinal Ganglion Cells' Receptive Field Center and its Adaptive Summing Area," and "Adaptive Sub-Units Within the Receptive Field Center of Cat Retinal Ganglion Cells." The development of a neuropharmacology lab designed to study neurotransmitters within the visual system has been started this year.</p>							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A NOV 83 AND 1498B 1 MAR 85 FOR ARMY USE ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL 175-2L DD-DR&E(AR)636	
3. BASE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REGRADING <sup>a</sup>	8. DRGFN INSTN <sup>a</sup>	9. SPECIFIC DATA CONTRACTOR ACCESS	10. LEVEL OF + A. WORK UNIT
80 10 01	R. CORRECTION	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
11. NO. CODES <sup>a</sup>	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
A. PRIMARY	61102A	3M161102BS10	CB	282			
B. CONTRIBUTING							
12. TITLE: Precede with Security Classification Code <sup>a</sup> STOG 80 7.2:4							
(U) Military Acoustic Hazards: Mechanisms of Hearing Loss							
13. SCIENTIFIC AND TECHNOLOGICAL AREA: 000200 Acoustics; 012400 Personnel Selection and Maintenance (medical); 007900 Industrial (occupational) Medicine							
14. START DATE	15. ESTIMATED COMPLETION DATE	16. FUNDING AGENCY	17. PERFORMANCE METHOD				
76 10	CONT	DA	C. In-House				
18. CONTRACT GRANT				19. RESOURCES ESTIMATE			
A. DATES/EFFECTIVE:				B. PREVIOUS			
B. NUMBER <sup>a</sup>				C. PROFESSIONAL MAN YRS			
C. TYPE:				D. FUNDS (in thousands)			
D. KIND OF AWARD:				E. CUM. AMT.			
F. CUM. AMT.				FISCAL YEAR			
				CURRENT			
				82			
20. RESPONSIBLE DOD ORGANIZATION				21. PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Labortory				NAME: US Army Aeromedical Research Lab			
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Pursuit 2848 if U.S. Army/DoD institution)			
NAME: Knapp, Stanley C.				NAME: Patterson, James H.,			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-4408			
22. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER:			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Mozo, Ben T.			
				NAME:			
				POC: DA			
23. (U) To establish the necessary and sufficient biomedical data base to support valid damage risk criteria to insure adequate hearing protection of Army personnel exposed to continuous noise.							
24. (U) Behavioral, histological, and electrophysiological procedures are used with animal models, and audiometric and psychophysical procedures are used with human subjects. Physical characteristics of continuous noise environments will be correlated with patterns of hearing loss.							
25. (U) 8010-8109 Progress on this project has been limited due to personnel shortages. Work has continued on data analysis and report preparation from the study of the role of pigmentation in susceptibility to noise induced hearing loss. Preliminary analysis indicates that pigmentation has no major role in determining susceptibility to hearing loss.							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, NOV 55, AND 1498B, 1 MAR 58, FOR ARMY USE, ARE OBSOLETE.

U.S. GPO: 1974-540-943 8691

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY					1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL
					DAOD 6735	81 10 01	DD-DR&E(AR)336
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. RESORCING <sup>a</sup>	8. DGRN INSTR <sup>a</sup>	9. SPECIFIC DATA- CONTRACTOR ACCESS	10. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
11. NO./CODES <sup>a</sup>	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
12. PRIMARY	62777A	3E162777A878	AG	137			
13. SECONDARY	61102A	3M161102B510	CB	281			
14. TITLE (Precede with Security Classification Code) <sup>a</sup>							
(U) Biodynamics of Impact Physiology							
15. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>							
001300 Aircraft; 002400 Bioengineering; 023300 Protective Equipment							
16. START DATE		17. ESTIMATED COMPLETION DATE		18. FUNDING AGENCY		19. PERFORMANCE METHOD	
66 12		CONT		DA		C. In-House	
20. CONTRACT/GRANT				21. RESOURCES ESTIMATE		22. FUND (In thousands)	
23. DATES/EFFECTIVE:				24. PROFESSIONAL MAN YRS		25. FUND (In thousands)	
26. NUMBER:				27. PRECISE		28. FUND (In thousands)	
29. TYPE:				30. FISCAL YEAR		31. FUND (In thousands)	
32. KIND OF AWARD:				33. CUM. AMT.		34. FUND (In thousands)	
35. RESPONSIBLE DOD ORGANIZATION				36. PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab			
ADDRESS: Fort Rucker, AL 36362				Biodynamics Research Division			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Precede with U.S. Standard Identification)			
NAME: Knapp, S. C.				NAME: Haley, J.L.			
TELEPHONE: 205-255-5107				TELEPHONE: 205-255-3001			
37. GENERAL USE				38. SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				NAME: Shanahan, D.F.			
				NAME: Hundley, T.A.			
				POC: DA			
39. REVISIONS (Precede with Security Classification Code) <sup>a</sup>							
(U) Helmet Testing; (U) Injury Prevention; (U) Protective Equipment; (U) Head Protection; (U) Bioengineering; (U) Body Armor Tests							
40. TECHNICAL OBJECTIVE, 41. APPROACH, 42. PROGRAM (Precede with individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To provide valid, meaningful biomedical impact criteria for the development of improved designs for whole body protection, and the means to assess the protective performance of helmets and whole body protective apparatus. Improved head protection from impact is very important because one of three aviation crash fatalities is a result of head and/or neck trauma.</p> <p>24. (U) The approach will be based on sound and accepted experimental bioengineering methods including mathematical modeling, pathophysiologic techniques, biomechanics, structural engineering, thermodynamics, and physics.</p> <p>25. (U) 8010-8109. This work unit supports the Army's designated responsibility for direct head-impact research for all three services. Work continues on the evaluation of energy absorbing polyurethane foam and different shells for head protection. Preliminary data have been obtained, and impact design recommendations for new flight helmets have been submitted to the AVRADCOM program manager. Energy-absorbing earcups were impact tested, both with inert mass and with human surrogates. Corrugated aluminum earcups have passed preliminary acoustic and impact tests. Continued support was provided to a tri-service contract to evaluate the tolerance of the human spine to vertical acceleration as imposed by the Blackhawk pilot's seat under crash conditions. Engineering evaluations of crash-damaged seats, restraints, and helmets for the Army Safety Center continued. A literature survey and a coordination visit were completed for initial planning of research to determine the secondary injury potential of body armor when defeating .50 cal ammunition. A Letter Report, LR 81-2-4-1, "Medical Design Criteria for Motorcyclist's Helmets" (Hundley) was written. The following papers were presented to the Aerospace Medical Association, May 81: "Impact and Vibration Testing of a Modified UH-1 Crew Seat" (Shanahan) and "United States Army Flight Helmet Performance" (Reading and Haley).</p>							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 85 AND 1498-1 1 MAR 88 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>1</sup>	2. DATE OF SUMMARY <sup>2</sup>	REPORT CONTROL (77b)(1)	
				DAOG 5998	81 10 01	DD-DR&E(A)J636	
3. DATE PREP SUMMARY	4. KIND OF SUMMARY	5. SUMMARY ACT <sup>3</sup>	6. WORK SECURITY <sup>4</sup>	7. REGRADING <sup>5</sup>	8. DISC. INSTR <sup>6</sup>	9. SPECIFIC DATA CONTRACTOR ACCESS	10. LEVEL OF SUB A. WORK UNIT
90 10 01	R. CORRECTION	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
11. NO. / CODES <sup>7</sup>	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
	62777A	9E162777A878	AA	136			
12. CONTINUING							
13. <del>13. CONTINUING</del>	STOG 80 7.2:4						
14. TITLE (Provide with Security Classification Code) <sup>8</sup>							
(U) Auditory Effects of Blast Overpressure							
15. SCIENTIFIC AND TECHNOLOGICAL AREA <sup>9</sup> 000200 Acoustics; 013300 Protective Equipment; 007900 Industrial (occupational) Medicine							
16. START DATE	17. ESTIMATED COMPLETION DATE		18. FUNDING AGENCY		19. PERFORMANCE METHOD		
80 10	CONT		DA		C. In-House		
20. CONTRACT/GRANT				21. RESOURCES EST. - \$		22. FUNDING ORIGIN	
23. DATE/EFFECTIVE:				24. EXP. DATE:		25. FUNDING ORIGIN	
26. NUMBER:				27. AMOUNT:		28. FUNDING ORIGIN	
29. TYPE:				30. CUM. AMT.		31. FUNDING ORIGIN	
32. KIND OF AWARD:				33. PERFORMING ORGANIZATION		34. FUNDING ORIGIN	
35. RESPONSIBLE S&T ORGANIZATION				36. PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab			
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Sensory Research Division Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Provide with H & S & A. Address Restriction)			
NAME: Knapp, Stanley C.				NAME: Patterson, James H., Jr.			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-4408			
37. GENERAL USE				38. ASSOCIATE INVESTIGATOR			
Foreign Intelligence Considered				NAME: Mozo, Ben T.			
39. REVERSED (Provide with Security Classification Code)				NAME: POC: DA			
(U) Acoustics; (U) Protective Equipment; (U) Industrial (occupational) Medicine; (U) Weapons Effects; (U) Impulse Noise; (U) Animals (U) Humans							
40. TECHNICAL OBJECTIVE, 41. APPROACH, 42. PROGRESS (Provide individual paragraphs identified by number. Provide rest of each with Security Classification Code)							
<p>23. (U) To define the physiologic effects upon the auditory system of blast overpressure generated by firing Army weapon systems. The physical characteristics of the pressure wave responsible for injury to the auditory system will be determined. Potential protective technology, approaches, and devices will be evaluated.</p> <p>24. (U) The approach is three pronged: 1. Physical measurements to define the nature of the noise and on which to base hazard assessment. 2. Direct validation of hearing protective devices and development of indirect methods to determine their adequacy. 3. Basic animal and human studies to develop a data base for more accurate tolerance limits (damage risk criteria) for impulse noise.</p> <p>25. (U) 8010-8109 A direct validation of hearing protection for the VIPER anti-tank weapon was completed with 34 volunteers. EAR earplugs were found to provide adequate protection for two rounds fired in rapid succession. A report is in preparation. A direct validation study of hearing protection for the M198/M203 was initiated. Data collection is in progress. Animal studies of the role of peak pressure in determining auditory injury were completed. Peak pressure was found not to be the major determinant of noise induced hearing loss. A report is in preparation.</p>							

Available to contractors upon originator's approval

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 63 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL	
				DAOB 6886	81 10 01	DD-DR&E (AR) 36	
3. DATE PREV. SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCT.	6. WORK SECURITY	7. REGRADING	8. DES'N INSTR.	9. SPECIFIC DATA: CONTRACTOR ACCESS	10. LEVEL OF R&D
80 10 01	D. CHANGE	U	U		NI	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
11. NO. / CODES		12. PROGRAM ELEMENT		13. PROJECT NUMBER		14. TASK AREA NUMBER	
A. PRIMARY		62777A		3E162777A878		AA	
B. CONTRIBUTING						135	
15. TITLE (Precede with Security Classification Code)		STOG 80 7.2.					
(U) Medical Assessment of Hearing Protective Devices							
16. SCIENTIFIC AND TECHNOLOGICAL AREAS: 000200 Acoustics; 013300 Protective Equipment; 007900 Industrial (occupational) Medicine							
17. START DATE		18. ESTIMATED COMPLETION DATE		19. FUNDING AGENCY		20. PERFORMANCE METHOD	
76 10		CONT		DA		C. In-House	
21. CONTRACT/GRANT				22. RESOURCES ESTIMATE		23. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				B. FISCAL YEAR		C. FUND (\$ Monthly)	
B. NUMBER:				81		3.2	
C. TYPE:				82		\$ 200	
D. KIND OF AWARD:						2.2	
E. CUM. AMT.						\$ 252	
24. RESPONSIBLE DOD ORGANIZATION				25. PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab			
ADDRESS: Fort Rucker, AL 36362				Sensory Research Division			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Precede with U.S. Academic Institution)			
NAME: Knapp, Stanley C.				NAME: Mozo, Ben T.			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-4408			
26. GENERAL USE				27. ASSOCIATE INVESTIGATORS			
Foreign Intelligence Considered				NAME: Goldstein, Jerod L.			
				NAME: Camp, Robert T., Jr.			
				POC: DA			
28. REVISIONS (Precede with Security Classification Code)							
(U) Acoustics; (U) Protective Equipment; (U) Humans; (U) Industrial (occupational) Medicine; (U) Aircraft; (U) Radio Communication; (U) Weapons Effect							
29. TECHNICAL OBJECTIVE, 30. APPROACH, 31. PROGRESS (Precede individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) This research assesses the sound-attenuating characteristics of passive and active hearing protective devices, establishes their suitability to meet the needs of the Army, develops new hearing protective devices, determines laboratory and field techniques for evaluation, and investigates any associated medical effects on audiologic performance.</p> <p>24. (U) Methods utilized for the determination of the sound attenuation characteristics of hearing protective devices will be ANSI Z22.24-1957 and ASA STD 1-1975. Objective laboratory and field electroacoustic methods will also be used.</p> <p>25. (U) 8010-8109. Completed the evaluation of several hearing protective devices to determine the acceptability for use in Army noise environments. They include: (1) DH-178 Helmet for use with the extended range M-198 Howitzer; (2) Active hearing protector muff for the infantry soldier to be used with shoulder-fired weapons and within the IFV; (3) IHADSS Helmet for use in the YAH-64 attack helicopter. Participated in a round-robin study conducted by the EPA Noise Enforcement Division to determine variability of attenuation characteristics of hearing protective devices when measured by different laboratories (letter report in progress). USAARL letter report LR 81-6-2-5, "Real Ear Sound Attenuation Measurements of a DH-132 Helmet in Combination with E-A-R Plugs," was completed. Measured the effect of training on the real-ear attenuation characteristics of the triple flange ear-plug (USAARL report in progress). Compared the attenuation characteristics of two parachutist helmets (USAARL LR 81-10-2-9, "Evaluation of Two Parachutist's Helmets.") Continued the development of a method to measure the sound attenuation characteristics of hearing protective devices using miniature microphones.</p>							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE DD FORMS 1498A 1 NOV 65 AND 1498-1 1 MAR 66 (FOR ARMY USE) ARE OBSOLETE



RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY					1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL <sup>a</sup>
					DAOG 0167	81 10 01	DD-DR&E(AR)436
3. DATE PREV SUMMARY <sup>a</sup>	4. KIND OF SUMMARY <sup>a</sup>	5. SUMMARY ACTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REGRADING <sup>a</sup>	8A. ORIGIN INSTR <sup>a</sup>	8B. SPECIFIC DATA: CONTRACTOR ACCESS <sup>a</sup>	9. LEVEL OF SUM <sup>a</sup>
80 10 01	D, CHANGE	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES <sup>a</sup>		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
A. PRIMARY		62777A		3E162777A878		AG	
B. CONTRIBUTING						131	
11. TITLE (Proceed with Security Classification Code) <sup>a</sup>		STOG 80 7.2.4					
(U) Biodynamics of Life Support Equipment and Personnel Armor							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>							
008800 Life Support; 016200 Stress Physiology; 002400 Bioengineering							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
78 10		CONT		DA		C. In-House	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				B. PRECEDING		C. FUNDS (in thousands)	
A. NUMBER:				FISCAL YEAR		81	
A. TYPE:				CURRENT		3.0	
A. KIND OF AWARD:				82		2.8	
F. CUM. AMT.						\$ 99	
20. RESPONSIBLE DOD ORGANIZATION				21. PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab			
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Provide SSAN if U.S. Academic institution)			
NAME: Knapp, S.C.				NAME: Shanahan, D. F.			
TELEPHONE: 205-255-5107				TELEPHONE: 205-255-3001			
22. GENERAL USE				23. ASSOCIATE INVESTIGATORS			
Foreign Intelligence Considered				NAME: Hundley, T.A.			
				NAME: Johnson, G.L.			
				POC: DA			
24. REVENUES (Proceed with Security Classification Code) <sup>a</sup>							
(U) Protective Equipment; (U) Stress Physiology; (U) Musculoskeletal Systems; (U) Biomedical; (U) Man-Machine Relationships							
25. TECHNICAL OBJECTIVE <sup>a</sup> , 26. APPROACH, 27. PROGRAM (Provide full technical paragraphs identified by number. Proceed rest of each with Security Classification Code.)							
<p>23. (U) To provide a technological data base relating to the biomedical aspects of the evaluation of life support equipment (LSE) and its correlation with injury data collected from the field, to identify hazard protection problems associated with LSE and to provide conceptual design recommendations and criteria to improve LSE and personnel armor, to provide evaluation of crash-related LSE through tri-service LSE Retrieval Program (LSERP).</p> <p>24. (U) Army aviation life support equipment involved in either injury causation or prevention in the field are sent to USAARL for biomedical and injury correlation evaluation. The evaluation assesses the effectiveness/deficiencies of the life support equipment through an analysis of the physical condition of the protective devices, the human injury incurred, and the related human dynamics involved in the accident. The analysis is accomplished by the application of epidemiologic methods, medically related engineering failure mode analysis, accident investigative procedures, forensic pathology, mathematical modeling and applied bioengineering research techniques.</p> <p>25. (U) 8010-8109. Presentations were made to the Joint Committee on Aviation Pathology (Head Injury in Helicopter Accidents as Related to Head Impact Simulation and Human Tolerance," Oct 80) and the Neuroelectric Society ("Head Impact Hazards in Helicopter Operations and their Mitigation Through Improved Helmet Design," Dec 80) concerning helmet damage/injury correlation. A paper was presented to the Aerospace Medical Association on US Army Life Support Training (May 81). Consultations were provided to the US Army Safety Center, the Air Force, and the Navy concerning injury prevention aspects of scientific life support equipment. LSERP reviewed over 50 Preliminary Report Aircraft Mishaps (PRAMS); 10 of these mishaps were made into case studies. The LSE returned from these accidents included 22 helmets (1 USAF and 4 USN), 4 restraint systems, and 5 seats. Evaluation letter reports were submitted to the appropriate service personnel for this equipment.</p>							

DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DO FORMS 1498A 1 NOV 88 AND 1498-1 1 MAR 89 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL DD-DR&E(AR)336	
3. DATE PREV. SUMM <sup>a</sup>	4. KIND OF SUMMARY	5. SUMMARY SCTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REGRADING <sup>a</sup>	8A. DATA HIST'N <sup>a</sup>	8B. SPECIFIC DATA CONTRACTOR ACCESS <sup>a</sup>	9. LEVEL OF RUM A. WORK UNIT
80 10 01	D. CHANGE	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES <sup>a</sup>	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
	62777A	3E162777A878	AD	132			
11. CONTRIBUTING							
XXXXXXXXXX	STOG 80 7.214						
12. TITLE (Precede with Security Classification Code) <sup>a</sup>							
(U) Vibration Hazards of Combat Aircraft and Vehicles							
13. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup> 007500 Human Factors Engineering; 009400 Man-Machine Relations; 012900 Physiology; 008800 Life Support.							
14. START DATE	15. ESTIMATED COMPLETION DATE	16. FUNDING AGENCY		17. PERFORMANCE METHOD			
80 10	CONT	DA		C. In-House			
18. CONTRACT/GRANT				19. RESOURCES ESTIMATE		20. FUNDING (in thousands)	
A. DATES/EFFECTIVE:				B. PREVIOUS		C. PROFESSIONAL MAN YES	
EXPIRATION:				FISCAL YEAR		D. FUNDING	
E. NUMBER <sup>a</sup>				81		3.5	
F. TYPE:				82		2.6	
G. KIND OF AWARD:						\$ 97	
H. CUM. AMT.						\$ 87	
21. RESPONSIBLE OGD ORGANIZATION				22. PERFORMING ORGANIZATION			
NAME <sup>a</sup> US Army Aeromedical Research Laboratory				NAME <sup>a</sup> US Army Aeromedical Research Lab			
ADDRESS <sup>a</sup> Fort Rucker, AL 36362				ADDRESS <sup>a</sup> Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Precede with U.S. Academic Institution)			
NAME: Knapp, S.C.				NAME <sup>a</sup> Wells, J.H.			
TELEPHONE: 205-255-5107				TELEPHONE: 205-255-3211			
23. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Behar, I.			
				NAME: Shanahan, D.F.			
				POC: DA			
24. NEW WORDS (Precede each with Security Classification Code) <sup>a</sup> (U) Vibration; (U) Stress; (U) Bioengineering; (U) Acuity; (U) Biodynamics; (U) Simulation; (U) Anthropometry; (U) Electromyography; (U) Fatigue; (U) Performance							
25. TECHNICAL OBJECTIVE, 26. APPROACH, 27. PROGRAM (Precede individual paragraphs identified by number. Precede text of each with Security Classification Code) <sup>a</sup>							
<p>23. (U) To conduct multidisciplinary basic and applied biomedical engineering research to provide a scientific data base of medically pertinent information and design criteria to reduce or alleviate vibration insult to the operator of developmental equipment and systems. To determine short-term and cumulative biomedical effects of vibration on the musculoskeletal system and develop technological methods by which to reduce these effects. To duplicate the field environment of vibration to study effects on human health and performance. To evaluate and develop medical criteria on human vibration tolerance and to provide collateral support to human tolerance studies and materiel development.</p> <p>24. (U) Determine dynamic characteristics of the advanced combat vehicle technology program seat by Fourier transform techniques using instrumented human subjects on the USAARL multi-axis vibration table. Assess stress and fatigue reactions, including back muscle stress and fatigue, associated with operation of vehicle controls, video displays, target acquisition systems, and seat coupled vibration by psychophysiological and electromyographic techniques. Make standard cardiopulmonary measurements.</p> <p>25. (U) 8010-8109. Three studies evaluating the High Survivability Test Vehicle-Light (HSTV-L) were completed. One study, "Neck and Muscle Stress Induced by Postural Effects and Vibration of Supine Seat" (Aerospace Medical Association, May 81), demonstrated: 1) significant increases in neck muscle stress in the full supine, head up position; 2) less neck muscle stress as the seat back angle became vertical; 3) greatly reduced head vibration frequencies above 20 Hz with the head off of the headrest. The dynamic visual acuity study demonstrated that target velocity increases on the HSTV-L monitor dramatically reduced acuity and acuity losses were much less for high contrast targets than for low contrast targets. The study of cardiopulmonary response demonstrated that with vibration cardiac output generally decreases by 10% and minute ventilation increases. A technical report, TR 81-3, "Vibration in a Helmet Mounted Sight" was also published.</p>							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 80 AND 1498B 1 MAR 80 FOR ARMY USE ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION#	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL	
				DACG 0169	81 10 01	DD-DR&E(ARM)36	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8. DRG'S MSTR	9. SPECIFIC DATA - CONTRACTOR ACCESS	10. LEVEL OF R&D
80 10 01	R. CORRECTION	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
11. NO. / CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
a. PRIMARY	62777A	3E162777A879	BT	168			
b. COTYPING	62777A	3E162777A878	AF	134			
c. COTYPING	STOG 80 7 2-4						
12. TITLE (Provide with Security Classification Code) (U) Biomedical Application and Health Hazard Assessment of Oxygen Enrichment Breathing Systems							
13. SCIENTIFIC AND TECHNOLOGICAL AREAS							
016200 Stress Physiology; 008800 Life Support; 001300 Aircraft							
14. START DATE	15. ESTIMATED COMPLETION DATE	16. FUNDING AGENCY	17. PERFORMANCE METHOD				
79 05	CONT	DA	C. In-House				
18. CONTRACT/GRANT			19. RESOURCES ESTIMATE		20. PROFESSIONAL MAN YRS		21. FUNDS OF \$ Thousands
a. DATES EFFECTIVE:			PRECEDENCE				
b. NUMBER:			FISCAL YEAR		81		2.5
c. TYPE:			CURRENT		82		2.7
d. END OF AWARD:							\$ 351
22. RESPONSIBLE DOD ORGANIZATION				23. PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Laboratory			
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Provide with U.S. Security Classification Code)			
NAME: Knapp, S.C.				NAME: Knox, F.S.			
TELEPHONE: (205) 255-6900				TELEPHONE: (205) 255-6933			
24. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
FIC				ASSOCIATE INVESTIGATORS			
				NAME: Chaffin, W.A.			
				NAME: Kessler, J.B.			
				POC: DA			
25. KEYWORDS (Provide with Security Classification Code) (U) Oxygen Supply Equipment; (U) Life Support; (U) Stress Physiology; (U) Aircraft; (U) Toxicology; (U) Human Volunteers							
26. TECHNICAL OBJECTIVE, 27. APPROACH, 28. PROGRESS (Provide individual paragraphs identified by number. Provide text of each with Security Classification Code)							
<p>23. (U) To identify, assess, and prevent unnecessary health hazards associated with the flight environment and to obtain a biomedical data base on the human function associated with the use of aircraft oxygen enrichment breathing systems in the flight environment. To provide the Army data, information, recommendations and criteria to aid in the development and deployment of life support systems to alleviate identified health hazards.</p> <p>24. (U) The approach will consist of a biomedical evaluation of state-of-the-art oxygen enrichment breathing systems during aircraft ground and flight conditions. The evaluation will include the sampling of the environmental air input to the system as well as the system output enriched air. The samples will be analyzed to determine the systems' ability to effectively filter contaminants known to exist in the operational environment. Physiological data, heart rate, oxygen tension and respiratory functions as well as system parameters, oxygen concentration, flow rates, temperatures and pressures will be collected during ground operations and aircraft flight at altitude to assess the ability of the system to provide aviators the required oxygen concentration and purity during various flight profiles. The data collected will be evaluated with respect to biomedical, safety, and man/machine limitations.</p> <p>25. (U) 8010-8109. Steady-state flight tests in the U-21 fixed wing aircraft have been completed. Results were reported at the Aerospace Medical Association 52nd Annual Meeting, 4-7 May 81, and in conferences at the Aviation Research and Development Command, 20-22 May 81, and the Directorate of Combat Developments, 30 Sep 81. Data collection in the UH-1 helicopter was delayed until late September 1981 due to difficulty in obtaining a safety-of-flight release. Two papers -- Onboard Oxygen Generation Systems (OBOGS): Army's Future Plans, and Flight Tests of OBOGS in Army Aircraft -- will be presented in Nov 81 at the Royal Air Force Institute for Aviation Medicine.</p>							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A AND 1498B 1 MAR 66 FOR ARMY USE ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL DD-DR&E(A)11636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	DAOG 0165	81 10 01		
80 10 01	D. CHANGE	U	U	7. REGARDING <sup>a</sup>	8A. DISSEM INSTR <sup>a</sup>	8B. SPECIFIC DATA- CONTRACTOR ACCESS <sup>a</sup>	9. LEVEL OF SUM <sup>a</sup>
					NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES <sup>a</sup>	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
A. PRIMARY	62777A	3E162777A879	BI	167			
B. <del>SECONDARY</del>	62777A	3E162777A87B	AF	133			
C. <del>TERMINAL</del>	STOG 80 7.2:4						
11. TITLE (Precede with Security Classification Code) <sup>a</sup>							
(U) Research Countermeasures for Significant Medical Hazards in Military Systems							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup> 006000 Escape, Rescue and Survivability 002400 Bioengineering							
016200 Stress Physiology							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
78 10		CONT		DA		C. In-House	
17. CONTRACT SPANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATE/EFFECTIVE				B. PREVIOUS		C. FUNDS (in thousands)	
B. NUMBER <sup>a</sup>				FISCAL		81	
C. TYPE:				YEAR		2.3	
D. KIND OF AWARD:				CURRENT		5.1	
E. CUM. AMT.						\$ 122	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME <sup>a</sup> US Army Aeromedical Research Laboratory				NAME <sup>a</sup> US Army Aeromedical Research Laboratory			
ADDRESS <sup>a</sup> Fort Rucker, AL 36362				ADDRESS <sup>a</sup> Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Knapp, S.C.				NAME <sup>a</sup> Knox, F.S.			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-3211			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER:			
FIC				ASSOCIATE INVESTIGATORS			
				NAME: Chaffin, W.A.			
				NAME: Nagel, G.A.			
				POC: DA			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Hazards; (U) Protective Equipment; (U) Stress Physiology; (U) Life Support; (U) Bioengineering; (U) Biochemistry							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRAM (Furnish individual paragraphs identified by number precede text of each with Security Classification Code.)							
23. (U) Conduct applied medical research to identify, assess and prevent unnecessary health hazards and personnel injuries imposed by exposure to the operational environment, toxic gases, oxygen levels, chemical and biological agents, and to provide the Army technical information, recommendations and standards to be used in the development and modification of systems that provide protection from those hazards.							
24. (U) The approach involves the application of physiological and biomedical applied research methods utilizing physical examinations, x-rays, and biochemical analysis techniques to isolate the hazards involved and determine required protective measures. These techniques will be applied to the establishment of biomedical requirements of environmental control systems and oxygen generating systems, life support survival equipment and aeromedical evacuation and rescue equipment.							
25. (U) 8010-8109. A protocol, "Physiological Assessment of the Aircrew Chemical Defense Ensemble" was written and approved. In Phase I the aviators flew alternately in the standard flying coverall, the US Chemical Defense Ensemble, and the United Kingdom (UK) Chemical Defense Ensemble. In Phase II, pilots wore developmental uniforms and body cooling garments. In both phases, physiologic, psychomotor and performance data were collected. Data are being analyzed and a report of preliminary results will be presented at the Tri-Service Aeromedical Panel Meeting, 19-23 Oct 81. Tri-service and tri-nation (US, Canada, UK) coordination has occurred. The test plan was presented at the following conferences: NBC Steering Committee, 8 Jul 81; USAF:CPT Wert, 6 Mar 81; US Army Research Institute of Environmental Medicine, 2 Apr 81; and Medical Attache, British Embassy Staff 10-12 Aug 81. Lectures were given on Chemical Defense to the Flight Surgeon Classes, 13 Mar 81 and 15 Sep 81; and Operation Problems Course at Ft Rucker, 2 Apr 81.							

DD FORM 1498  
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 65 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL <sup>a</sup>	
				DAOB 6893	81 10 01	DD-DR&E(AR)436	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REGRADING <sup>a</sup>	8. DDD'S INSTR <sup>a</sup>	9. SPECIFIC DATA CONTRACTOR ACCESS <sup>a</sup>	10. LEVEL OF SUM <sup>a</sup>
80 10 01	D. CHANGE	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
11. NO CODES <sup>a</sup>	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
A. PRIMARY	62777A	3E162777A879		BG		164	
B. CONTRIBUTING							
STOG80-7.2:4							
11. TITLE (Precede with Security Classification Code) <sup>a</sup>							
(U) Military Visual Problems: Assessment, Mechanisms, and Protection							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup> 0012000 Optics; 012400 Personnel Selection and Maintenance; 009400 Man-Machine Relations							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
76 10		CONT		DA		C. In-House	
17. CONTRACT GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE				B. FISCAL YEAR		C. FUNDS (in thousands)	
EXPIRATION:				81		6.0	
B. NUMBER <sup>a</sup>				82		\$ 344	
C. TYPE				CURRENCY			
D. KIND OF AWARD				5.2		\$ 562	
E. AMOUNT:							
F. CUM. AMT.							
20. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME <sup>a</sup> US Army Aeromedical Research Lab				NAME <sup>a</sup> US Army Aeromedical Research Lab			
ADDRESS <sup>a</sup> Fort Rucker, AL 36362				ADDRESS <sup>a</sup> Sensory Research Division Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Precede with U.S. Academic Institution)			
NAME: KNAPP, Stanley C.				NAME <sup>a</sup> BEHAR, Isaac			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-6714			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: HOLLY, F. F.			
				NAME: HARDING, T. H.			
				POC: DA			
22. KEYWORDS (Precede EACH with Security Classification Code) <sup>a</sup> (U)Aircrew Selection; (U)Optical/Ophthalmic Material; (U)Animal; (U)Photometry/Radiometry; (U)Man-Machine Compatibility; (U)Visual Performance; (U)Human							
23. TECHNICAL OBJECTIVE <sup>a</sup> 24. APPROACH, 25. PROGRESS (Precede individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) The technical objectives are to develop methods for assessing potential visual problems created by military operational environments, to establish the underlying mechanisms of these visual problems, and to evaluate methods for protecting and enhancing visual performance. The data provided will impact: (a) crew selection and retention standards; (b) optimal visual performance criteria; (c) observer-display compatibility; and (d) assessment of medical and non-medical material.</p> <p>24. (U) The approach will include physical optics techniques of photometry, radiometry, and colorimetry; optics lab testing of distortion, prismatic deviation, power, transmittance, haze, neutrality, and resolution; psychophysical studies using human and animal observers; and neurophysiological studies using gross potential and single-cell recording.</p> <p>25. (U) 8010-8109. Red instrument lighting was found to preserve the observer's sensitivity for out-of-the-cockpit viewing to a greater extent than does blue-white lighting under conditions of nearly total darkness but not under full moon illumination. Under whole-body vibration, decrements in static and dynamic visual acuity have been shown to be quantitatively related to vibration amplitude, head position, target contrast, and target velocity. Other accomplishments include: USAARL LR-81-1-2-1, Effects of reduced combiner transmission in the integrated helmet and display sighting system; USAARL LR 81-7-2-6, Feasibility of utilizing a photochromic combiner in the integrated helmet and display sighting system; USAARL LR 81-8-2-7, A reflection analysis of alternative canopy curvatures for the Advanced Attack Helicopter; Proceedings, Aerospace Medical Association, May 1981, San Antonio, TX, Operational laser screening examinations, and a comparison of visual fields with fixed and moving fixation points.</p>							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 85

AND 1498-1, 1 MAR 88 (FOR ARMY USE) ARE OBSOLETE

U.S. GPO: 1974-546-845/8691

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL <sup>a</sup>	
				DAOG 1490	81 10 01	DD-DR&E(A)	
3. DATE PREV SUMMARY <sup>a</sup>	4. KIND OF SUMMARY <sup>a</sup>	5. SUMMARY ICT <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REGRADING <sup>a</sup>	8. DISSEM. RATE <sup>a</sup>	9. SPECIFIC DATA CONTRACTOR ACCESS <sup>a</sup>	10. LEVEL <sup>a</sup>
80 10 01	R. CORRECTION	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK
11. NO / CODES <sup>a</sup>		PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER		
A. PRIMARY		61101A	3A161101A91C	00	278		
B. CONTRIBUTING							
C. CONTRIBUTING							
12. TITLE (Provide with Security Classification Code) <sup>a</sup>							
(U) Assessment of Visual Performance Based Upon New Knowledge of Retinal Function							
13. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>							
012000 Optics; 012900 Physiology							
14. START DATE		15. ESTIMATED COMPLETION DATE		16. FUNDING AGENCY		17. PERFORMANCE METHOD	
81 03		82 09		DA		C. IN-HOUSE	
18. CONTRACT/GRANT				19. RESOURCES ESTIMATE		20. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				PRECEDENCE		B. FUNDS (In thousands)	
B. NUMBER <sup>a</sup>				FISCAL YEAR		2.0	
C. TYPE				CONTRACT		30	
D. KIND OF AWARD				82		0.5	
E. CUM. AMT.						15	
21. RESPONSIBLE DOD ORGANIZATION				22. PERFORMING ORGANIZATION			
NAME <sup>a</sup> US Army Aeromedical Research Laboratory				NAME <sup>a</sup> US Army Aeromedical Research Lab			
ADDRESS <sup>a</sup> Fort Rucker, AL 36362				ADDRESS <sup>a</sup> Sensory Research Division			
				Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Provide SSAN if U.S. and/or foreign)			
NAME: Knapp, S. C.				NAME <sup>a</sup> Holly, F. F.			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-6319/6415			
23. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER:			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Behar, I.			
				NAME: Harding, T. H.			
				POC: DA			
24. REVENUE (Provide each with Security Classification Code) <sup>a</sup>							
(U) Vision; (U) Visual Psychophysics; (U) Visual Performance; (U) Visual Sensitivity; (U) Visual Screening; (U) Volunteers							
25. TECHNICAL OBJECTIVE, 26. APPROACH, 27. PROGRAM (Provide individual paragraphs identified by number. Provide text of each with Security Classification Code.)							
<p>23. (U) This basic research program will attempt to identify mechanisms subserving selected visual tasks and to develop advanced testing procedures which quantitatively examine the visual skills of military personnel. Two distinct parallel pathways have been discerned in the visual system and their properties suggest that one channel (sustained) may be predominantly involved in the resolution of fine spatial detail within a visual scene whereas the other channel (transient) may be more involved in the detection of coarse, moving targets. Current optometric tests of visual resolution may provide only limited information about one of these channels.</p> <p>24. (U) Our approach is twofold. One approach is to evaluate the sensitivity characteristics of the sustained channel by presenting spatial stimuli of two different colors both within and outside of the adapting area. The second approach is to evaluate a method for the rapid assessment of contrast sensitivity which may provide a new research and clinical tool.</p> <p>25. (U) (8103-8109) The evaluation of the sensitivity characteristics of the sustained channel has been completed. It was found that: 1) under simulated ambient conditions of nearly total darkness red lighting preserves dark adaptation from 10 to 20 times better than does blue-white lighting which means that red lighting must be retained in the cockpit. 2) under simulated full moon illumination there was no difference between the red and blue-white lighting, 3) there was a large amount of spreading of adaptational effects to the non-stimulated area of the visual field which cannot be explained solely by stray light. The construction of the apparatus for the second approach, spatial bandwidth equalization, has been nearly completed.</p>							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DO FORMS 1498A, NOV 63 AND 1498-1, 1 MAR 65, FOR ARMY USE, ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMMARY <sup>a</sup>	4. KIND OF SUMMARY <sup>a</sup>	5. SUMMARY SCTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REGRADING <sup>a</sup>	8A. DESIG INSTR <sup>a</sup>	8B. SPECIFIC DATA CONTRACTOR ACCESS <sup>a</sup>	9. LEVEL OF SUB A. WORK UNIT
80 10 01	R. CORRECTION	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO / CODES <sup>a</sup>	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
A. PRIMARY	62777A	3E162777A879	BH	166			
B. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) <sup>a</sup>							
(U) Anthropometric Criteria for Army Aviators							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>							
009400 Man-Machine Relationships; 012900 Physiology; 001300 Aircraft							
13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY		16. PERFORMANCE METHOD			
80 11	84 02	DA		C. In-House			
17. CONTRACT/GRANT		18. RESOURCES ESTIMATE		A. PROFESSIONAL MAN YRS		B. FUNDS (\$ thousands)	
A. DATES/EFFECTIVE:		PRECEDENCE		FISCAL YEAR		FUNDING	
B. NUMBER <sup>a</sup>		81		2.0		\$ 174	
C. TYPE:		82		4.9		\$ 259	
D. KIND OF AWARD		F. CUM. AMT.					
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME <sup>a</sup> US Army Aeromedical Research Laboratory				NAME <sup>a</sup> US Army Aeromedical Research Lab			
ADDRESS <sup>a</sup> Fort Rucker, AL 36362				ADDRESS <sup>a</sup> Biodynamics Research Division			
				Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish NAME, U.S. ADDRESS including)			
NAME: Knapp, S C				NAME <sup>a</sup> Schopper, A W			
TELEPHONE: 205-255-5107				TELEPHONE: 205-255-3001			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
				ASSOCIATE INVESTIGATOR			
				NAME: Wells, J H			
Foreign Intelligence Considered				POC: DA			
22. REVISIONS (Precede EACH with Security Classification Code) <sup>a</sup>							
(U) Anthropometrics; (U) Aircraft; (U) Strength;							
(U) Aviation Medicine; (U) Performance; (U) Human Volunteer							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede each of each with Security Classification Code.)							
<p>23. (U) The increased concern and emphasis upon the use of women in the US Army has resulted in the need to reevaluate the anthropometric criteria cited in AR 40-501 concerning Class 1, 1A, and 2 flying duty. Cockpit design criteria (MIL STD 1472 B) indicate that aircraft designers are to utilize dimensions corresponding to the 5th through the 95th percentile male. Standards cited in AR 40-501 are not consistent with these guidelines, and previously conducted research has indicated that personnel smaller than the 5th percentile male are capable of flying some Army aircraft. Hence, a need exists to reevaluate and modify, as appropriate, extant anthropometric criteria.</p> <p>24. (U) Anthropometric measurements, to include strength and weight measurements, will be obtained from individuals (male and female) whose statures are less than 64 inches or greater than 73 inches. Data from these individuals will be compared with the cockpit-related dimensions and individuals will be placed in aircraft to determine the static linear and anthropometric criteria. Weight criteria will be determined on the basis of their interrelationship with crash-survivability considerations, aircraft weight and balance considerations, and medical guidance regarding obesity. Strength criteria will be recommended after consideration of both the maximal force required to fly selected Army aircraft and the evaluation of sustained physical exertion upon cognitive and psychomotor capabilities while performing multielement tracking tasks using aircraft controls which require varied levels of physical force input for their operation.</p> <p>25. (U) 8010-8109. Due to lack of funding until 8108, progress was limited to pilot tests evaluating cardiovascular response to large numbers of repeated, brief isometric exertions, variation in sitting height as a result of exposure to vibration, and the in-house fabrication of apparatus to evaluate dynamic arm and leg strength.</p>							

<sup>a</sup> Available to contractors upon contractor's request.

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 63 AND 1498-1, 1 MAR 66, FOR ARMY USE, ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>		2. DATE OF SUMMARY <sup>a</sup>		REPORT CONTROL SYMBOL DU-DR&E(ARM)16	
3. DATE PREVIOUS SUMMARY <sup>a</sup>		4. KIND OF SUMMARY <sup>a</sup>		5. SUMMARY SECURITY <sup>a</sup>		6. WORK SECURITY <sup>a</sup>		7. AGENCY ACCESSION <sup>a</sup>	
80 10 01		D. CHANCE		U		U		NL	
10. NO./CODES <sup>a</sup>		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
A. PRIMARY		62777A		3E162777A879		BH		165	
B. CONTRIBUTING									
C. COORDINATING		STOG 80 7.2:4							
11. TITLE (Precede with Security Classification Code) <sup>a</sup> (U) Aeromedical Research of Operationally Significant Problems in the Army Aviation Environment									
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>									
003500 Clinical Medicine 012900 Physiology 001300 Aircraft									
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD			
78 10		CONT		DA		C. In-House			
17. CONTRACT DATA <sup>a</sup>									
A. DATES/EFFECTIVE:									
B. NUMBER:									
C. TYPE:									
D. KIND OF AWARD:									
E. CUM. AMT.									
18. RESPONSIBLE DOD ORGANIZATION									
NAME: US Army Aeromedical Research Laboratory									
ADDRESS: Fort Rucker, AL 36362									
RESPONSIBLE INDIVIDUAL									
NAME: KNAPP, S.C.									
TELEPHONE: (205) 255-5107									
21. GENERAL USE									
FIC									
22. PERFORMING ORGANIZATION									
NAME: US Army Aeromedical Research Laboratory									
ADDRESS: Fort Rucker, AL 36362									
PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)									
NAME: KIMBALL, K.A.									
TELEPHONE: (205) 255-2319									
SOCIAL SECURITY ACCOUNT NUMBER:									
ASSOCIATE INVESTIGATORS									
NAME: DUNCAN, C.E.									
NAME: SIMMONS, R.R.									
POC: DA									
23. (U) Stress; (U) Biomedical Evaluation; (U) Aircraft; (U) Psychology; (U) Recording Devices; (U) Human Volunteers; (U) Aviation Medicine									
24. (U) The objective of this project is to provide a definitive assessment of medical problems peculiar to the aviation environment and prepare guidelines for field commanders on the impact of these problems on the aviation mission. The results of such research will aid in development of improved standards and biomedical techniques for the field flight surgeon to use in monitoring and treating aviator stress and fatigue as well as the medical standards for selection of aviators and air traffic controllers for specific assignments.									
25. (U) A multidisciplinary approach, utilizing physiological measuring techniques, flight surgeon assessments, as well as aircraft comparisons, will provide the method to analyze aviator performance in the operational environment. Parameters to be measured will include heart rate, respiration, biochemical stress indices, and inflight performance measurements.									
26. (U) 8010-8109. Progress has been demonstrated by responding to request from Health Service Command to send a research team to four Air Ambulance Units to evaluate and define hazards incurred by the units due to their unique military mission and environment. A similar request has been received from the Commander, US Army Aviation Center. Results of the progress within this program have been presented at the 7th Medical Command Aviation and Medical Conference, "Crew Rest and Workload," November 1980.									

<sup>a</sup>Available to contractors upon originator's approval

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 69 AND 1498-1, 1 MAR 69 (FOR ARMY USE) ARE OBSOLETE



RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				AGENCY ACCESSION <sup>1</sup>		DATE OF SUMMARY <sup>2</sup>		REPORT CONTROL SYMBOL	
				DAGC 0156		81 10 01		DD-DR&E(AR), 36	
A. DATE PREPARED <sup>3</sup>		B. KIND OF SUMMARY		C. SUMMARY ACT <sup>4</sup>		D. WORK SECURITY		E. RESEARCH <sup>5</sup>	
80 10 01		R. CORRECTION		U		U		NL	
F. SPECIFIC DATA - CONTRACTOR ACCESS <sup>6</sup>		G. LEVEL OF R&D <sup>7</sup>		H. WORK UNIT					
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO									
I. NO. / CODES <sup>8</sup>		J. PROGRAM ELEMENT		K. PROJECT NUMBER		L. TASK AREA NUMBER		M. WORK UNIT NUMBER	
A. PRIMARY		62777A		3E162777A879		5H		162	
N. CONTRIBUTING		O. DATE/PLACE		P. STOG 80 7.2:4					
Q. TITLE (Precede with Security Classification Code) <sup>9</sup>									
(U) Visual Performance Research Related to Operational Problems in Army Aviation									
R. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>10</sup>									
012900 Physiology; 009400 Man-Machine Relations; 013400 Psychology; 001300 Aircraft									
S. START DATE		T. ESTIMATED COMPLETION DATE		U. FUNDING AGENCY		V. PERFORMANCE METHOD			
78 10		CONT		DA		C. In-House			
W. CONTRACT/GRANT				X. RESOURCES ESTIMATE		Y. PROFESSIONAL MAN YRS		Z. FUNDS (in thousands)	
A. DATE/EFFECTIVE:				B. PRECEDENCE		C. FISCAL YEAR		D. CURRENT YEAR	
E. NUMBER:				F. 81		G. 2.5		H. \$ 301	
I. TYPE:				J. 82		K. 1.3		L. \$ 191	
M. KIND OF AWARD:				N. CUM. AMT.					
O. RESPONSIBLE DOD ORGANIZATION					P. PERFORMING ORGANIZATION				
NAME: US Army Aeromedical Research Laboratory					NAME: US Army Aeromedical Research Laboratory				
ADDRESS: Fort Rucker, AL 36362					ADDRESS: Biomedical Applications Research Div Fort Rucker, AL 36362				
RESPONSIBLE INDIVIDUAL					PRINCIPAL INVESTIGATOR (Precede with U.S. Government)				
NAME: Knapp, S.C.					NAME: Simmons, R.R.				
TELEPHONE: (205) 255-6900					TELEPHONE: (205) 255-6931				
Q. GENERAL USE					R. SOCIAL SECURITY ACCOUNT NUMBER:				
FIC					ASSOCIATE INVESTIGATORS				
					NAME: Kimball, K.A.				
					NAME: Stone, L.W.				
					POC: DA				
S. KEYWORDS (Precede with Security Classification Code) <sup>11</sup>									
(U) Visual Performance; (U) Eye Movement; (U) Military Aircraft; (U) Man-Machine Relations; (U) Psychology; (U) Recording; (U) Human Volunteers									
T. TECHNICAL OBJECTIVE, 14. APPROACH, 15. PROGRESS (Precede with Security Classification Code) <sup>12</sup>									
23. (U) Visual perception to Army aircrews is critical for pilotage, navigation, and weapon utilization to fulfill various tactical requirements. The objective of this project is to provide US Army aviation information regarding the visual performance of fixed and rotary wing aviators during varying tactical missions. Special emphasis will be placed on the objective quantification and interpretation of these data and their relation to variables such as pilot physiological and psychological states and task loading.									
24. (U) The approach will involve the utilization of an oculomotor monitoring and recording device for visual data collection during flight. Areas of research to be addressed will include: aviator visual performance during conditions of VFR, IFR, night, and nap-of-the-earth flights; day and night navigation; scout helicopter operations, and varying aircraft comparisons. Measurements of dwell times, scan rates, fixations, and zones of workload will be analyzed to provide visual performance criteria and models. Additionally, data collection equipment and techniques are being designed to provide the ability to record visual data under night flight conditions and data analyses project.									
25. (U) 8010-8109. Major efforts for the fiscal year were expended toward a joint laboratory research program with the US Coast Guard Research and Development Center on "Visual Detection Strategy of US Coast Guard Observers." Progress in the visual performance research has been demonstrated by three reports in the US Army Aviation Digest-- "The Real Thing" (Oct 80); "Down and Dirty" (Nov 80); and "25th Century Today" (Mar 81)-- and one article published in the Army Research, Development, and Acquisition magazine, "Aviation Night Vision Goggles with Sub-miniature Instrument Display" (May/June 1981). Presentation was made to American Helicopter Society Annual Meeting, May 81, "Comparison of Helicopter Copilot Workload While Using Three Navigation Systems During Nap-Of-the-Earth Flight."									

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORM 1498A, NOV 81, AND 1498B, 1 MAR 82, FOR ARMY USE, ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL DD-DR&E(AR)436	
3. DATE PREV SUMMARY <sup>a</sup>	4. KIND OF SUMMARY	5. SUMMARY SCTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REGRADING <sup>a</sup>	8. ORIGIN HISTORY <sup>a</sup>	9. SPECIFIC DATA CONTRACTOR ACCESS	10. LEVEL OF RUM
81 03 18	D. CHANGE	U	U	NA	NL	<input type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
11. NO./CODES: <sup>a</sup>		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
A. PRIMARY		6.11.01.A		3A161101A91C		00	
B. CONTRIBUTING						279	
C. CONTRIBUTING							
12. TITLE (Precede with Security Classification Code) <sup>a</sup>							
(U) Cardiopulmonary Physiology in Army Aviators							
13. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>							
012900 Physiology; 016200 Stress Physiology; 012400 Personnel Selection and Maintenance							
14. START DATE		15. ESTIMATED COMPLETION DATE		16. FUNDING AGENCY		17. PERFORMANCE METHOD	
81 03		83 02		DA		C. IN-HOUSE	
18. CONTRACT/GRANT				19. RESOURCES ESTIMATE		20. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				B. PRECEDING		C. FUNDS (in thousands)	
D. NUMBER <sup>a</sup>				FISCAL YEAR		D. FUNDS (in thousands)	
E. TYPE:				CURRENT		100	
F. KIND OF AWARD:				82		3.0	
G. CUM. AMT.						15	
21. RESPONSIBLE DOD ORGANIZATION				22. PERFORMING ORGANIZATION			
NAME <sup>a</sup> US Army Aeromedical Research Laboratory				NAME <sup>a</sup> US Army Aeromedical Research Lab			
ADDRESS <sup>a</sup> Fort Rucker, Alabama 36362				Biomedical Applications Rsch. Div.			
				ADDRESS <sup>a</sup> Fort Rucker, Alabama 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Precede with U.S. Academic Institution)			
NAME: Knapp, S. C.				NAME <sup>a</sup> Kessler, J. B.			
TELEPHONE: (205) 255-5107				TELEPHONE (205) 255-7112			
23. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Campbell, D. L.			
				POC: DA			
24. KEYWORDS (Precede EACH with Security Classification Code) <sup>a</sup>							
(U) Aviators; (U) Pulmonary Physiology; (U) Stress Physiology; (U) Volunteers							
25. TECHNICAL OBJECTIVE, 26. APPROACH, 27. PROGRESS (Precede individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To develop and define relevant physiological parameters, for active duty Army aviators, which can be applied to medical selection and retention criteria; develop and validate discreet levels of combat fitness, for active duty Army aviators, based on selected cardiopulmonary parameters.</p> <p>24. (U) To establish statistically validated levels of physiological fitness, among the subject, active duty Army aviator population, based on the innovative application of the following technologies: water-sealed spirometry, infrared spectrophotometry, body plethysmography, ear oximetry, lung-Nitrogen wash-outs, Helium iso-flows and dilutions, closing volumes, pulmonary capillary diffusions, airway resistances, non-invasive cardiac output and respiratory quotient determinations.</p> <p>25. (U) (8103-8109) Protocol approved by US Army Medical Research and Development Command (USAMRDC), using advanced cardiopulmonary technology to categorize Army aviators into groups of combat fitness. Ultra-modern cardiopulmonary equipment obtained and installed in the cardiopulmonary laboratory - fully operational by early FY 82. US Army Aeromedical Research Laboratory (USAARL) cardiopulmonary technicians have been completely trained by parent company in use of new equipment. Initial test subjects have been run on new equipment to resolve technical problems that may exist. Statistical methodology for study has been fully developed. Sample population size and composition has been devised using DA population tables for active duty Army aviators. Coordination has begun with the Aeromedical Center to procure subjects for study.</p>							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 85 AND 1498B 1 MAR 86 FOR ARMY USE ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY					1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL DD-DR&E(AR)436
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REORDING <sup>a</sup>	8. DISSEM INSTN <sup>a</sup>	9. SPECIFIC DATA- CONTRACTOR ACCESS	10. LEVEL OF DIS- A. WORK UNIT
80 10 01	D. CHANGE	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO / CODES <sup>a</sup>	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
a. PRIMARY	62777A	3E162777A879	BH	161			
b. CONTRIBUTING							
c. XXXXX XXXX XXXX	TOG 80 7.2:4						
11. TITLE (Precede with Security Classification Code) <sup>a</sup> (U) Research Directed at Biomedical Parameters Affecting Aircrew Workload During Sustained Operations							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>							
013400 Psychology		001300 Aircraft		016200 Stress Physiology			
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
78 10		CONT		DA		C. In-House	
17. CONTRACT GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDENCE		b. FUNDS (In thousands)	
EXPIRATION:				81		3.8	
c. TYPE:				FISCAL YEAR		\$ 278	
d. KIND OF AWARD:				82		1.6	
e. CUM. AMT.						\$ 141	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Laboratory			
ADDRESS: Fort Rucker, AL 36362				Biomedical Applications Research Div			
				ADDRESS: Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Knapp, S.C.				NAME: Stone, L. W.			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-3211			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER:			
FIC				ASSOCIATE INVESTIGATORS			
				NAME: Simmons, R.R.			
				NAME: Duncan, C.E.			
				POC: DA			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Man-Machine Relations; (U) Military Aircraft (U) Phys- chology; (U) Aviation Medicine; (U) Stress; (U) Sustained Operations; (U) Human Volunteers							
23. (U) Little is known about the medical problems which extended operations have on helicopter aircrews. The objective of this project is to assess the biomedical parameters which affect aviation personnel during sustained military operations. The overall re- sults of the research will provide a baseline criteria for: (a) physiologic measures of workload, stress and fatigue; (b) the effect of workload, stress, and fatigue on extended performance; (c) Army aviation personnel requirements for sustained operations; and (d) the fatigue and stress effects caused by special operational equipment such as night vision goggles or helmet mounted sight systems.							
24. (U) The approach will involve the utilization of inflight and simulator monitoring and recording systems capable of sampling and recording continuous analog and digital information in experiments designed to measure pilot performance and aircraft response. These recording systems and statistical techniques will be utilized to quantify and predict aviator performance levels and subsequent man-system efficiency as a function of extended military operations.							
25. (U) 8010-8109. During FY 81, data from the extended flight in the simulator study were reduced in summary form and due to lack of sufficient professional manpower were submitted for contract analyses. The visual performance data analyses contract is to be completed FY 82. Preliminary results from this research study were presented at the Aerospace Medical Association Annual Scientific Meeting, May 81, "Rotary Pursuit Tracking Task Performance in Conjunction with Extended Flight in a (Helicopter) Simulator"; and USAARL Technical Report No. 81-1, "Aeromedical Factors in Aviator Fatigue, Crew Work/ Rest Schedules and Extended Flight Operations: An Annotated Bibliography."							

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 83  
AND 1498-1, 1 MAR 88 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>a</sup>	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL	
				DACG 5101	81 10 01	DD-DR&E/AR1036	
3. DATE PREV. SUMMARY <sup>a</sup>	4. KIND OF SUMMARY <sup>a</sup>	5. SUMMARY SETTING <sup>a</sup>	6. WORK SECURITY <sup>a</sup>	7. REGRADING <sup>a</sup>	8A. DISSEM. INSTR. <sup>a</sup>	8B. SPECIFIC DATA: CONTRACTOR ACCESS <sup>a</sup>	9. LEVEL OF SUB <sup>a</sup>
80 10 01	R. CORRECTION	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES <sup>a</sup>		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
A. PRIMARY		62777A		3E162777A879		5H	
B. CONTRIBUTING						163	
C. DISSEMINATING		STGS 50 7.2:4					
11. TITLE (Provide with Security Classification Code) <sup>a</sup>							
(U) Parametric, Multimodal Workload Assessment in Aircraft Guidance Systems							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>							
012900 Physiology; 009400 Man-Machine Relations; 013400 Psychology; 001300 Aircraft							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
80 10		84 12		DA		C. In-House	
17. CONTRACT GRANT				18. RESOURCES ESTIMATE		A. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE				B. FISCAL YEAR		C. FUNDS (in thousands)	
B. NUMBER <sup>a</sup>				81		2.0	
C. TYPE				82		0.8	
D. KIND OF AWARD				F. CUM. AMT		S 70	
E. CUM. AMT						S 97	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME <sup>a</sup> US Army Aeromedical Research Laboratory				NAME <sup>a</sup> US Army Aeromedical Research Laboratory			
ADDRESS <sup>a</sup> Fort Rucker, AL 36362				Biomedical Applications Research Div			
				ADDRESS <sup>a</sup> Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Provide SSAN if U.S. and/or foreign institution)			
NAME: Knapp, S.C.				NAME <sup>a</sup> Hamilton, B.E.			
TELEPHONE: (205) 255-6900				TELEPHONE: (205) 255-6977			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
FIC				ASSOCIATE INVESTIGATORS			
				NAME: Cote, D.A.			
				NAME: Mastroianni, G.			
				POC: DA			
22. REVISIONS (Provide EACH with Security Classification Code) <sup>a</sup>							
(U) Visual-Motor Performance; (U) Military Aircraft; (U) Workload; (U) Physiology; (U) Psychology; (U) Human Volunteers							
23. (U) The increased sophistication of aircraft instruments and weapon system displays has placed the aviator in danger of being unable to process available information in a timely fashion. This potential problem is exacerbated when the aviator is fatigued, a situation which will undoubtedly occur in the modern high-intensity battlefield. The objectives of this research are to programmatically evaluate existing and newly developed psychological measures of fatigue and cognitive overload and identify those which are: (a) suitable for use during actual flight, (b) most sensitive to changes in level of fatigue or sensory input, and (c) best suited for predicting flight performance changes.							
24. (U) Fatigue and cognitive overload problems in aircrews will be documented by on-site visits to tactical units. As a problem area is identified, it will be broken down into component elements, with an emphasis on classifying problems according to theoretical constructs. Once a theoretical construct (e.g., short-term memory overload) has been identified, it will be evaluated by integrating appropriate tests and experimental procedures into a visual/psychomotor tracking task which will be designed to simulate various aspects of flight. As an understanding of the problem area is gained, verification of this knowledge and evaluation of countermeasures will be conducted in a flight simulator and under actual flight conditions. Finally, the recommendations are to be taken back to the tactical units for user evaluation.							
25. (U) 8010-8109. Due to the transfer of the principal investigator, the initiation of this project has been delayed until appropriate professional manpower can be secured.							

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION <sup>a</sup>	2 DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL DD-DR&E(AH) 616	
3 DATE PREV SUMMARY <sup>a</sup>	4 KIND OF SUMMARY <sup>a</sup>	5 SUMMARY ACT <sup>a</sup>	6 WORK SECURITY <sup>a</sup>	7 REGRADING <sup>a</sup>	8A DOWN INSTR <sup>a</sup>	8B SPECIFIC DATA CONTRACTOR ACCESS <sup>a</sup>	9 LEVEL OF SUM A. FOR UNIT
81 03 18	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES <sup>a</sup>		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
A. PRIMARY		6.11.01.A		3A161101A91C		00	
B. CONTRIBUTING						277	
C. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) <sup>a</sup>							
(U) Effects of Nerve-Agent Antidotes on the Visual System							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>a</sup>							
012000 Physiology; 012600 Pharmacology; 016800 Toxicology							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
81 03		82 09		DA		C. IN-HOUSE	
17. CONTRACT, GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				PRECEDING		B. FUNDS (in thousands)	
A. NUMBER <sup>a</sup>				FISCAL YEAR		81	
A. TYPE:				CURRENT		1.5	
A. KIND OF AWARD:				82		70	
A. AMOUNT:				1.5		20	
F. CUM. AMT.							
20. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME <sup>a</sup> US Army Aeromedical Research Laboratory				NAME <sup>a</sup> US Army Aeromedical Research Laboratory			
ADDRESS <sup>a</sup> Fort Rucker, Alabama 36362				ADDRESS <sup>a</sup> Fort Rucker, Alabama 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic institution)			
NAME: Knapp, S.C.				NAME <sup>a</sup> Aplan, J. P.			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-2773/5114			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME:			
				NAME:			
				POC: DA			
22. KEYWORDS (Precede EACH with Security Classification Code)							
(U) Nerve Agents (U) Antidotes (U) Vision (U) Animal Model (U) Aplysia							
23. TECHNICAL OBJECTIVE <sup>a</sup> 24. APPROACH, 25. PROGRAM (Furnish individual paragraphs identified by number. Precede each with Security Classification Code)							
<p>23. (U) To develop a method of screening nerve agent antidotes for effects on the visual system using the marine mollusc <i>Aplysia</i> as a relevant animal model. To determine the effects of antidotes directly on nerve cells at the various levels of the visual system, and on transmission of messages between the cells. To aid in development of antidote drug preparations which will not impair vision and thus compromise the ability of the soldier to accomplish his missions.</p> <p>24. (U) To study electrical responses of <i>in vitro</i> photoreceptor and visual-system cells to nerve-agent antidotes. Membrane potential, resistance, and current responses will be measured intracellularly in extra-retinal photoreceptor cells and then in cells at the various levels of the isolated eye-otic nerve-cerebral ganglion preparation. Effects of antidotes on discharge rates and transmission between cells will also be studied. The ionic basis of antidote action will be determined by chemical and pharmacological means.</p> <p>25. (U) (8103-8109) A new laboratory has been set up and equipped. Equipment has been ordered, received, and assembled into a working electrophysiological recording system. Biological preamplifiers, a digital current injection controlling device, a digital display, and electrode positioners have been designed, constructed, and tested. A photic stimulator system has been designed and assembled. Preliminary experiments to study the responses of extra-retinal photoreceptor cells in a biological model, <i>Aplysia</i>, have been performed.</p>							

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION#	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
				DAOG 8399	82 03 01	DD FORM 1498-1
3. DATE PREV. SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8. DOWNSIDE INSTR.	9. SPECIFIC DATA: CONTRACTOR ACCESS
81 10 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
10. NO / CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER		
a. PRIMARY	62734A	3M162734A875	AO	381		
b. CONTRIBUTING	62772A	3S162772A875	AO			
<del>*****</del> STOG 80-7.2.1						
11. TITLE (Provide with Security Classification Code)						
(U) Antidote and Antidote/Agent Effects on the Visual System						
12. SCIENTIFIC AND TECHNOLOGICAL AREA						
012900 Physiology; 012600 Pharmacology; 016800 Toxicology						
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD
80 05		CONT		DA		C. IN-HOUSE
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		
a. DATES/EFFECTIVE:				a. PROFESSIONAL MAN YRS		
b. NUMBER:				b. FUNDS (in thousands)		
c. TYPE:				c. PRECEDING		
d. KIND OF AWARD:				d. FISCAL YEAR		
e. CUM. AMT.				e. COUNTRY		
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION		
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Laboratory		
ADDRESS: Fort Rucker, Alabama 36362				ADDRESS: Sensory Research Division		
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Provide SSAN if U.S. Academy Institution)		
NAME: Knapp, S.C.				NAME: Kirby, A.W.		
TELEPHONE: (205) 255-6900				TELEPHONE: (205) 255-6815		
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER		
				ASSOCIATE INVESTIGATORS		
				NAME: Wiley, R.W.		
				NAME: Harding, T.H.		
				POC: DA		
22. KEYWORDS (Provide each with Security Classification Code)						
(U) Visual Physiology; (U) Visual Neuropharmacology; (U) Visual Anatomy; (U) Retina; (U) Nerve Agents; (U) Antidotes; (U) Autoradiography; (U) Animals						
23. (U) This project is a component of the US Army Medical Research and Development Command Chemical Defense program which is determining the neural effects of chemical agents and developing antidotes to defeat them. The primary objective of this research program is to determine the effects of the administration of nerve agents and/or their antidotes on retina or higher visual administration of these substances will be quantified and an assessment made of performance loss due to drug exposure. The sites of action and uptake of antidotes and agents within the visual system will also be studied.						
24. (U) The approach will include single and multiple neuron recording (gross potentials) techniques in anesthetized animals. By examining each area of interest before and after drug administration, drug related effects on overall visual function can be obtained. Autoradiography and other localization and histochemical techniques will be used to localize sites of action and uptake. Gross potential data will be compared to both anatomical findings and obtained from single unit studies to provide an overall picture of visual system function following antidote/agent insult. Results from these studies will be used to infer actions on the impairment of the human visual system and the ability of the soldier to visually complete his mission.						
25. (U) None.						

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